

TECHNICAL BULLETIN – TB229

TILE FINISHES - FLOOD WATER IMMERSION

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INTRODUCTION

Since the recent flood episodes throughout much of Eastern Australia, the questions being asked of the building industry include queries regarding the effect the flood water would have had over wall and floor tile finishes, particularly those in residential dwellings. The short answer is “it depends”. This paper is an attempt to raise awareness of the factors involved regarding typical tile installations.

Tiles

The tile types are typically described by the degree of water absorption of the body of the tile (expressed as a percentage of the dry weight of the tile), by the method of manufacture (e.g. extruded or dust pressed, once fired or twice fired) and by the finish (i.e. glazed or unglazed). Thus tiles with low rates of water absorption (e.g. porcelain) will be largely unaffected by immersion in flood waters. Tiles with high rates of water absorption (e.g. glazed clay tiles and terracotta tiles) may show discoloration and/or staining. Natural stone tiles may also experience discolouration.

Installation of tiles

Traditional tile fixing methods involved fixing porous bodied tiles in a wet cement mortar (i.e. wet bed method) using a cement slurry as the bonding bridge between the wet mortar and the back of the tile. In this method, the tile was soaked in water prior to installation.

For the last 20 years or so, the tiles have been made larger and less porous due to better manufacturing processes. These denser tiles are typically adhesive fixed using thin bed (i.e. up to 3mm bed thickness) or thick bed (i.e. average 6mm bed thickness), polymer-improved cement based adhesives that are applied to the dry prepared substrate using a notched trowel and the tile is installed without soaking first.

The difference between these methods is that the traditional wet bed method normally achieves full contact behind the tile while the notched trowel method can leave voids and holes in the adhesive layer under the tile. Australian Standard 3958-2007 provides a guide to the recommended minimum contact of the adhesive to both the back of the tile and the substrate to which it is applied. To achieve these recommended minimum contact levels, the standard also recommends the size of the notched trowel to use with different sized tiles. Increasing the trowel size as the tile size increases overcomes any concavity that has resulted from the firing process. Large format (i.e. >450mm square face size) may be slightly concave (i.e. domed) across the back of the tile so that the adhesive is not in full contact to support the centre area of the tile unless the tile is pressed into the wet adhesive layer. Buttering of additional adhesive over the back of the tile also achieves the required contact. Pressing with a back- and- forth sliding action collapses and squashes the lines of adhesive together as well as filling the voids and achieving high contact between the tile and the substrate. It is important to note that the standard recognizes that adequate adhesion can be achieved with less than 100% adhesive contact between the tile and the substrate except when the tiles will be in immersed situations such as swimming pools. The standard recommends the tiles should be solidly bedded so that voids behind them are eliminated as far as possible. Reduced contact of the adhesive to both the substrate and the back of the tile also increases the risk of bond failure. We note that the most commonly used trowel for fixing floor tiles of all sizes is a 10mm notch trowel which may mean there is insufficient adhesive to fully bed large format tiles in a continuous layer of adhesive.



AS3958 guidelines regarding the minimum trowel size to use when fixing different size tiles to internal areas that will be dry after the tile installation.

- 200 x 200mm tiles – use a 8mm notched trowel
- 250 x 250mm tiles – use a 10mm notched trowel
- 300 x 300mm tiles – use a 12mm notched trowel
- 400 x 400mm and larger size tiles – use a 12mm notched trowel + back buttering of tile.

Note: the above trowel size guidelines apply to (C) cement based & (R) reaction resin based adhesives that can be applied up in a continuous layer up to 10mm thickness. Dispersion (D) premixed paste adhesives are generally for thin bed applications up to 3mm thickness (maximum) as excessive thickness may lead to prolonged drying and shrinkage of the dispersion adhesive. The over-riding instruction is that all adhesives are to be applied in accordance with the manufacturers' instructions regarding bed thickness.

The standard guidelines regarding the recommended minimum contact coverage of the tile adhesive to both the tile and the substrates are as follows:

- Internal residential walls - 65%
- Commercial and Industrial walls – 80%
- Wet Areas and Swimming Pools – 90%
- External Walls – 90%.
- Residential floors – 80%
- Commercial and Industrial floors – 90%
- External floors, decks and roofs – 90%

The effect of flooding tiled areas where the tiles have voids/holes in the adhesive layer is that these voids become filled with the flood water. While the grout between the tiles will provide some resistance to the penetration of water borne contaminants and/or particulate debris where the grout is intact, most tile grouts are cement based products and therefore are porous.

Flood water

The flood water can include various types of contaminant depending from where it has travelled. Water from agricultural areas can include pesticides and fertilizers, animal wastes and bacteria from dead animals, as well as fine debris such as grass, silt and sand. In other areas, sewer systems can be flooded to such an extent that the effluent is forced back up the drains and/or the treatment plants are flooded so the effluent escapes in an uncontrolled way. Industrial areas may provide contaminants such as oils, paint, solvent and other chemicals that may be hazardous health and/or damaging to the tiling materials such as cement based adhesives and grouts. For example, high concentrations of sulfate (expressed as SO₃.) can react and erode materials containing Portland cement. The end result is that contaminants in the water can be carried into the voids between the tile and the substrate to which it is fixed where the sediment is deposited as the flood waters recede.

Drying

Drying of tiled installations can be prolonged due to the duration and degree of saturation that has occurred and the relative lack of exposure for drying of the wet substrates. For example, concrete floors are frequently tiled with dense (low porosity) tiles. Concrete and cement based topping screeds are porous and relatively absorbent compared to a porcelain floor tile. Concrete (and topping screeds) are also much thicker than the tile finish thus able to absorb a lot of water depending upon the duration of the flood. With the perimeters of the tile finish and the grout lines being the areas where drying by evaporation can occur after the flood waters have gone, prolonged drying can be expected. Foul smells can become noticeable and fungi/mould growth may become evident along with efflorescent deposits appearing on the surface.



Floor tiling is generally done using cement based adhesives which generally more suited to immersed conditions. However the application method of the adhesives gives rise to the concern regarding holes/voids in the adhesive layer which can trap contaminants and result in foul smells and unhygienic conditions for the residents.

We note that concrete floor substrates are generally undamaged in flood events and can be cleaned, sanitized and prepared for new tile finishes. However timber flooring is often water damaged to such an extent that removal and replacement is the only option prior to re-tiling or installing other types of floor finishes.

Another concern with floor tiling is that some tile installations, especially large format tiles, may have been adhesive fixed to floor levelling cements. These specialty levelling cements typically are not moisture resistant and when immersed, will become soft and mushy. The result is the tiles become loose and the entire installation must be removed and redone.

Wall tiling is generally replaced as the internal wall substrates such as sheet linings (plasterboard and/or fibre cement sheeting) are removed due to water damage and to repair/replace damaged services. The removal of these substrates also allows removal of accumulated sediment that has deposited in the wall cavities.

The above discussion is an introduction into dealing with the aftermath of immersion of tile wall and floor finishes in contaminated flood waters. Replacement of the tile finishes generally has only been considered for the wall tiling and wall substrates. The floor tiling mostly remains because appearance of the floor tiles tends to show little or no damage compared to the wall tile finishes. This may not be the safest option when the installation methods of the tiles and the prolonged drying of the contaminated areas are considered. In addition, the effect of flood water immersion on moisture sensitive tiles (e.g. some natural stone tiles) is not discussed, nor is the effect of substrate movement related to the flood event.

IMPORTANT

This Technical Bulletin provides guideline information only and is not intended to be interpreted as a general specification for the application/installation of the products described. Since each project potentially differs in exposure/condition specific recommendations may vary from the information contained herein. For recommendations for specific applications/installations contact your nearest Ardex Australia Office.

DISCLAIMER

The information presented in this Technical Bulletin is to the best of our knowledge true and accurate. No warranty is implied or given as to its completeness or accuracy in describing the performance or suitability of a product for a particular application. Users are asked to check that the literature in their possession is the latest issue.

REASON FOR REVISION

Clarify thin /thick bed applications to trowel size selections.

DOCUMENT REVIEW REQUIRED

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