

# CONSTRUCTION

October 2013 Vol. 55 No. 7

C A N A D A

Photo courtesy Schluter-Systems

## The 10 MOST COMMON Waterproofing Mistakes for Hard Surface Installations

By Dale Kempster, CSC, CTC, TTMAC

**B**ased on his experiences investigating failed showers for the past two decades, David Gobis, a forensic consultant in the tile and stone industry, estimates roughly half the showers in the United States are leaking.<sup>1</sup> This is a bold statement and, although the percentage of Canadian showers that leak may not be quite as high, the situation in this country is similar.

One tell-tale sign of the problem is many builders do not offer tiled showers as a standard item, but only as an upgrade, if they offer them at all. A North American hotel chain is seriously evaluating the trade-off between the positive guest experience provided by a tiled shower, and the additional costs they have incurred repairing showers that were not specified or installed correctly.<sup>2</sup> However, the problems they have experienced are completely preventable.

Tile and stone are among the most luxurious and sustainable building materials available. Their value as hard surfaces is appreciated by property owners and managers, tenants, architects, designers, and builders. In correctly installed assemblies, the materials have no

volatile organic compounds (VOCs), lifecycles can be up to 50 years, and often include recycled content. Despite these benefits, some businesses re-consider their use in some wet areas because of past problems.

The common denominator for these problems is most failures are completely avoidable and are due to mistakes made while waterproofing. Proper waterproofing is a meticulous and essential part of the design and construction process in any wet environment, whether it is a shower, a steam-room, or an exterior deck. Unfortunately, when a mistake is made with waterproofing in these environments, the consequences can be severe and the repair cost can be excessive.

This article addresses 10 different mistakes that almost always result in leaking or other various failures where waterproofing has been used with hard surfaces.

### **Mistake 1: Believing tile, grout, and sealer are inherently waterproof**

Tile used with epoxy grout, or a sealer applied over cementitious grout, is not waterproof, and is particularly susceptible to vapour

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Steam showers must be constructed with a vapour retarder that has a perm rating of 0.5 or less at 90 percent relative humidity (RH).

and steam. An example of a large failure is the dormitory of an eastern Canadian university. In this case, approximately 50 failed showers were found in four buildings.

Only seven months after installation, water could be seen leaking and running down the hallways. Part of the problem was not only the misperception tile and grout are waterproof, but also the drywall used was only waterproofed to 300 mm (12 in.) above the shower curb. This installation method is relatively low cost, and the installer assumed the liquid-applied waterproofing was not needed any further up the wall because the tile was waterproof. Unfortunately, this core assumption is incorrect.

To avoid this failure, the waterproofing must be installed at least to the shower head, and preferably to the ceiling. In this instance, the university's showers were all repaired using this waterproofing method.

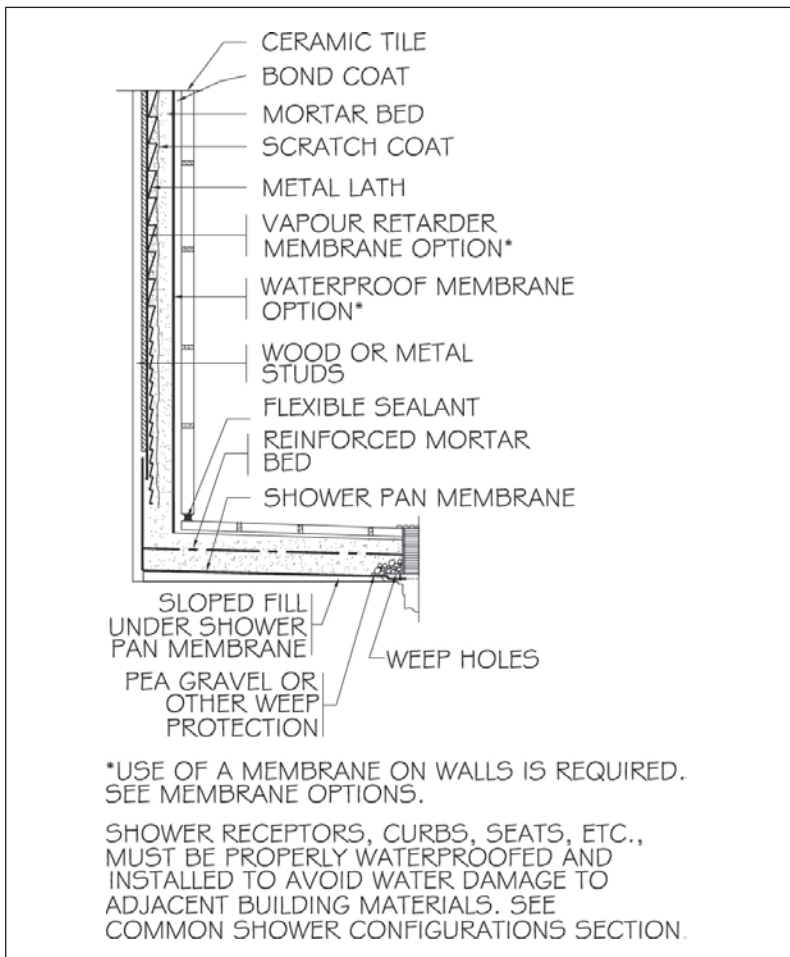
### **Mistake 2: Creating little or no slope-to-drain, or even negative slope**

When using a traditional mortar bed, there is a shower pan liner that needs to have a pre-slope of approximately two percent. This pre-slope is critical to ensure subsurface moisture can actively work its way to the two-stage drain used in this assembly. Additionally, weep holes must be kept open so moisture can evacuate from the area. This can be done easily by using a sub-surface drainage mat on the waterproofed pre-slope that provides rapid water drainage to the lower section of the two-stage drain.

Another solution to consider is to use a topical waterproofing membrane meeting American National Standards Institute (ANSI) A118.10, *Load-bearing, Bonded, Waterproof Membranes for Thin-set Ceramic Tile and Dimension Stone Installations*, in combination with a drain that has an integrated bonding flange. This eliminates the need for a pre-slope since the waterproofing is atop the substrate. This assembly also reduces the overall height of the floor, and makes it easier to manage transitions at doorways and fixtures. Proper slope is extremely important for exterior decks where freeze and thaw conditions can play havoc if the water is not properly evacuated from the deck area.



Inadequate moisture management can lead to efflorescence that destroys the appearance of the tile installation.



The pan-liner in a shower that was built using a traditional mortar bed must be pre-sloped to the two-stage shower drain.

### Mistake 3: Creating penetrations through the waterproofing membrane

Causes of penetrations and punctures in waterproofing membranes can be as simple as nailing a piece of backerboard through the membrane on a curb, or using nails or screws as spacers to stack tile on a shower wall. Penetrations through the waterproofing layer should be avoided at all costs, especially on horizontal surfaces where water can easily collect. This is an especially big concern for exterior decks where penetrations to secure railings through the waterproofing almost always result in a leak, even if caulked. As required by *National Building Code of Canada (NBC)*, installing the mountings for railings in the side of the deck's fascia is a far safer method.

### Mistake 4: Using wood in a shower to make a bench or curb

Even if pressure-treated and waterproofed with a liquid or sheet-applied membrane, 2x4 lumber often warps as it dries out. The warping and twisting can compromise the waterproofing and/or the tile installed directly over top. There are now prefabricated

Styrofoam, and expanded polystyrene foam (XPS) and extruded polystyrene (EPS) components for curbs, benches, and other structural elements that, when waterproofed, are dimensionally stable and provide a solid backing for the tile. Using wood does not guarantee installations will fail, but it has properties making it more likely.

### Mistake 5: Assuming all waterproof membranes are also vapour retarders

This is a big misunderstanding that can be especially disastrous in continuous-use steam rooms and high-use residential steam showers. In the past, a vapour retarder for a shower being tiled directly onto, had to have a perm rating no greater than 1.0. With the latest revision of the Terrazzo, Tile, and Marble Association of Canada (TTMAC) 09 30 00, *Tile Installation Manual*, the requirement has been made more stringent—0.5 perm or less using ASTM E96, *Standard Test Methods for Water Vapor Transmission of Materials*, Procedure E, at 90 per cent relative humidity (RH).

At a recent technical committee meeting of the National Tile Contractors Association (NTCA), the topic of steam rooms came up. One person vocalized his frustration and indicated he had not seen one continuous-use steam room last much more than five years. As a matter of fact, this author has seen steam rooms in some health and fitness spa facilities fail in as little as six months.

The waterproof membrane manufacturer should be consulted to confirm its actual perm rating, and that the rating is based specifically on Procedure E of ASTM E96, as there are six different procedures under this standard. These different procedures are for various environments and applications, and Procedure E best suits the environment for a steam room at 37.8 C (100 F) at 90 per cent RH. (This is the highest temperature tested in any of the procedures.)

### Mistake 6: Not recognizing the potential for efflorescence to occur in wet environments

Efflorescence occurs when soluble salts in the mortar rise with moisture through the grout joints to the surface and deposit a white, or yellowish, residue. This residue can be difficult to remove and may even require use of a sulfamic or phosphoric acid. Efflorescence is a natural occurrence with any portland cement-based product, and the best way to control and prevent it is to manage the moisture.

In the case of showers done in the traditional mortar-bed system, the addition of a drainage mat on the shower pan liner

With today's manufacturing technology, porcelain tiles can be made to look just like stone and only an expert would know the difference from the real thing.



Photo courtesy Schluter-Systems

*Tiles in wet areas that do not have at least 95 per cent coverage are much more likely to come loose or break.*

reduce or even eliminate efflorescence altogether. The same could be said for exterior decks where a primary waterproofing layer has been applied and a mortar bed 32 to 50 mm (1.2 to 2 in.) thick has been installed with ungauged stone.

#### **Mistake 7: A lack of coverage when installing tile**

The TTMAC 09 30 00 *Tile Installation Manual* specifies tiles installed in wet areas should have a minimum coverage of 95 per cent. For this to be accomplished, the tile typically needs to be back-buttered, meaning a thin coat of mortar is applied to the tile's back with the flat side of the trowel. When there is insufficient coverage, the tile or stone often displays some shading and, since the voids collect water, the chances for efflorescence increases. There is also a much greater risk of tiles delaminating, which represents a major failure and added cost for many projects.

#### **Mistake 8: Improperly prepared waterproofing membrane**

The industry standard for load-bearing, bonded waterproof membranes for thin-set ceramic tile and dimension stone installation is ANSI A118.10. There are three types of membranes that fall under this standard:

- trowel-applied;
- peel-and-stick; and
- sheet-applied.

The least expensive of the three is the liquid or trowel-applied membrane, which is often mistakenly considered to be the easiest to install. The challenge with this type of product is it requires a manufacturer-specified thickness that can be measured by a film thickness gauge. Often, to achieve the required thickness, more than one coat is required, and in some cases, a reinforcement fabric is needed, especially for inside corners.

Another challenge is keeping the thickness consistent and within the standard. Insufficient coverage does not necessarily result in actual leaks until the area exposed to moisture becomes saturated. This may take days, weeks, or months, but once it starts to leak, there can be water infiltration behind the walls and a lot more damage than initially meets the eye.

Peel-and-stick and sheet-applied membranes are often more expensive, but have the advantage of being manufactured in the factory to the correct thickness. This reduces the chances for installer error. A disadvantage, however, is when dealing with radiuses and other irregular shapes, in which case a trowel-applied membrane is certainly easier to apply.

#### **Mistake 9: Failure to do a proper flood test**

Imagine not checking to see if a shower floor can actually hold water. This can be done easily by using a plumber's ball or

other similar stopper after the waterproofing has been installed to the drain—whether it is a two-stage drain for a traditional mortar bed or a drain with an integrated bonding flange. This simple test can prevent a major disaster from occurring; it is certainly worth the small amount of time and effort for the peace of mind that is gained.

This test is conducted by putting a plumber's ball in the drain to block the water from draining. The shower is then filled up with water a few inches below the curb. It is left for several hours (or overnight), and the installer leaves a story line for the waterproofing, verifying the water has not dropped and there is no leak.

### **Mistake 10: Inappropriate tile and stone selections for wet areas**

A stone such as travertine, limestone, or sandstone is often specified because the home or building owner likes the material's esthetic. These are sedimentary stone products, which typically mean they are quite porous. Porous stone requires ongoing maintenance such as frequently applying a sealer. With today's tile manufacturing technology, a porcelain tile can be made to look just like stone and only an expert would know the difference from the real thing.

Glass tile has also become a popular choice, especially as cheaper imports become more readily available. Often, these glass tiles are in sheets and are mesh-mounted. Before installing any glass mosaic, the coverage of the mesh should be verified. Also, the adhesive holding the mesh should not be covering the majority of the tile back. Too much adhesive is a bond-breaker as the thin-set will only bond to the adhesive rather than to the tile itself. A simple evaluative test is to take a sheet of the mosaic and put it into a bucket of water to sit overnight. If the mesh comes off easily, this is a good indication the tile is unsuitable for use in a wet area. The tile is likely to fall off the wall within weeks, once it gets saturated from a few showers.

### **Conclusion**

A properly designed and installed tiled shower, steam room, or deck should last as long as the building it is in. By avoiding the most common waterproofing mistakes at the planning, design, and installation stages builders can ensure their installations are truly sustainable. It is much easier and less costly to incorporate complete moisture management into the project design, than to repair the results of mould and water damage later. 📌

### **Notes**

<sup>1</sup> This information comes from conversations between the author and technical consultant, David Gobis. Also, see "Waterproofing Tragedies", in the March/April 2010 issue of *Floor Covering Installer*.

<sup>2</sup> See Note 1.



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