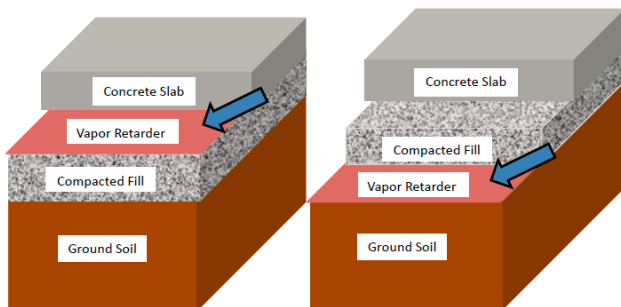


ASSESSING TILE ASSEMBLIES FOR DAMAGE IN FLOOD CONDITIONS

Ceramic and natural stone tiles are used in wet areas because they can last for centuries in these conditions where many other flooring types do not hold up. However, under flood conditions, both substrates and cement-based adhesive mortars are affected by pressure from the water intrusion along with high moisture vapor emission. Efflorescence can also occur when the materials are drying out. Any of these conditions can lead to failure of the tile assembly.

Wood framed substrates for tile installations will obviously deform and flooring failure would be recognized easily when covered by flood waters. This may not be the case with concrete slab on ground applications. Why? When flood waters saturate the tile assembly and the concrete and gravel base for the slab, there are a number of factors that delay visibility of the failure for an extended period of time. These include the manner in which the concrete base and vapor retarder was designed, ground topography and soil type, water pressure and moisture retention.

Notice the vapor retarder placement in the illustrations below. When the vapor retarder is placed directly under the concrete slab, after the slab dries, this ends the effect of moisture. When the vapor barrier is under the fill, the gravel creates a bladder layer which holds on to moisture much longer* and if a vapor retarder is damaged or was not used, moisture is not controlled at all.



*Up until 2001, ACI (the American Concrete Institute) recommended the gravel fill above the vapor retarder. The change was due to recognizing that rain and ground water easily enters the gravel fill.

Until moisture levels decrease to pre-existing conditions and seasonal temperatures cycle stabilize, it may be difficult to determine if an existing tile installation will stay intact. Factors that affect the long term stability include:

- Whether or not the slab moved and if it will settle due to soil displacement.
- Did the water pressure loosen the mortar bond so that traffic and reconstruction will cause delamination later? (This is more likely when the slab was not prepared properly during the installation or mortar coverage was less than 95 %.)
- In the drying process, when the assembly and slab shrink, where tile is butted to walls or cabinets without movement joints, there may be compressive forces that shear or loosen bond.
- When the concrete dries, soluble salts can migrate to the underside of the tile causing efflorescence crystals that expand with great force and adversely affect the surface bond line, resulting in failure.
- Cement grouts may exhibit discoloration from efflorescence. If the installation is well adhered after the assembly dries and stabilizes, treatments can be performed to recolor the grout lines.

When assessing a flooded tiled floor that is not obviously damaged, **always** allow water to recede and moisture vapor levels to stabilize by allowing tile assembly and substrate to dry. Allow moisture levels to decline to normal levels. These levels are conditional based on the city location/environment including proximity to groundwater; annual rainfall and humidity levels. Consider this carefully regarding inspections, assessments for damages and insurance compensation settlements.

A sound tile installation may be determined by assessing grout hardness and/or cracking along with sounding tile for movement and adhesion. Areas that

ASSESSING TILE ASSEMBLIES FOR DAMAGE IN FLOOD CONDITIONS

previously were without hollow sounds but now have some resonance when tapped, may very well be an indication of concrete slab movement or adhesive failure. Slabs have also been known to relax as they out dry quickly and curl upwards, then moisture content equalizes and they lay flat.

For new installations it is generally accepted that less than 85% RH when measured per ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; or less than 10lbs as measured by ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride is acceptable.

CUSTOM® [RedGard® Uncoupling Mat](#) is a membrane can even be placed over slabs with moisture up to 100% RH prior to re-tiling as it has air channels to allow moisture to escape, providing that ground water is not causing negative hydrostatic pressure. (Negative hydrostatic pressure normally occurs when the slab is lower than the soil and water is exerting pressure. In floods or poor drainage conditions, water saturates the soil and migrates into concrete, especially near hillsides.)



So what should you do after the tile or stone assembly is flooded and you're unsure if there's damage?

1. **Wait** until the substrate and the property truly dries out before making a final assessment.
2. Examine the grout for cracks and hardness. Use the end of a quarter (25¢ coin) and gently rub the joint. If the grout is damaged, remove

a section and examine the tile's bond. You may elect to re-grout after the assembly has dried.

3. Carefully tap on the tile with a chisel end or drop a golf ball and listen for hollow sounds.
4. Have a building inspector and/or professional forensic tile firm expert examine the floor.

If there is damage and the floor needs replacement, consider the following:

1. Wait until the substrate and the property truly dries out before reinstallation.
2. Remove not only the tile but also all traces of the adhesive from the concrete. Grinding the slab surface will help moisture escape and remove any weak surface and existing efflorescence, thus increasing your ability to bond well to the concrete. Assess any slab cracks. Note that when cracks are wider than 1/8" or out of plane, these are considered structural issues. A professional repair might be needed before proceeding.
3. Use [RedGard® Uncoupling Mat](#) and a high performance mortar such as [ProLite® Premium Large Format Tile Mortar](#) to install the mat and reset the tile or stone.

Ensure that you leave space at all perimeters of the installation and where the tile abuts cabinets and doorframes to allow for slab movement and shrinkage. Use [Commercial 100% Silicone Sealant](#) to treat these spaces.

Some may have concerns regarding slab contamination from the flood waters or the formation of mold under their tile. As there are so many variables to correctly assess these conditions, only use a certified inspector based on recommendations for FEMA or local city administrations to provide qualified answers and any necessary steps.

If you have additional questions, please visit www.custombuildingproducts.com or contact your local CUSTOM representative.

ASSESSING TILE ASSEMBLIES FOR DAMAGE IN FLOOD CONDITIONS

Disclaimer: The information and suggestions from Custom Building Products are provided above as a professional courtesy and are a broad overview of possible conditions that might occur. For specific recommendations on your project, you may choose to consult a professional for advice prior to action. Custom Building Products takes no responsibility for suitability of assessment or remediation methods taken as a result of providing information above.

The information in this bulletin is presented in good faith, but no warranty, express or implied, is given nor is freedom from any patent in as much as any assistance furnished by CUSTOM with reference to the safe use and disposal of its products provided without charge. Custom Building Products assumes no obligation or liability therefore, except to the extent that any such assistance shall be given in good faith.

TB101 10/17

