

Technical Article: Written by Scott Worthington.

### External Efflorescence?

Over the years I have been asked many times about the effectiveness of penetrating sealers in reducing the amount of soluble salt that can come from external sources namely the sea. Just last week an architect from Dubai posed this question once again. However he was even more specific in his questioning, going as far as proposing that they could not work. His reasoning was as follows: If a penetrating sealer allows vapour transmission then it follows that internal soluble salts from sources such as the cement, sand, stone or tile can escape through the sealer as water vapour. However he also reasoned that the reverse would happen. This means soluble salts such as those from the ocean can be carried with water vapour into the stone making the sealer ineffective at controlling efflorescence in a stone or porous tile installation.

On the face of it this argument seems totally logical. However the reasoning is flawed, as it does not take into account several important factors that are at work on a sealed stone or tile surface. On an unsealed porous surface there are a number of things that affect the amount, degree and depth to which a liquid can be absorbed. The most obvious is the porosity or ability of the material to absorb water. A highly porous surface will absorb water quickly and deeply where it can react with soluble salts. The surface tension also affects the amount of absorption. For example polished and unpolished versions of the same stone on a vertical surface will absorb different amounts of water because the polished version is relatively hydrophobic compared to the unpolished.

When these same stones are sealed with a good penetrating sealer such as our Aqua Mix Sealers Choice Gold or Ultra Solv the first thing that happens is the stone or tiles natural water absorption is reduced. The second thing that happens is the sealer makes the surface hydrophobic by altering the surface tension. This reduces the overall contact surface area thus reducing the rate and overall quantity of water absorption. And by reducing the absorbed water (the catalyst for efflorescence) the overall risk of efflorescence is reduced. Of course we are talking here of penetrating sealers that allow good vapour transmission so any internal water vapour and soluble salt can pass through the sealer barrier by way of evaporation.

Let's look at what happens to the same sealed surface when the salt is delivered externally. The premise is that salt can be deposited on the surface from a source like the sea. Once on the surface a soluble salt can be dissolved and then transported into the stone by way of water vapour the same way it can come out. For this to happen the water absorption of the stone or tile has to be high and the force created by the capillary action has to be greater than that of the evaporation created by heat. On a sealed surface this simply will not happen because the combination of low water absorption and relatively low surface tension created by the sealer enable the force of evaporation (also remember heat rises) to easily take over resulting in little to no soluble salt being transported internally into the tile or stone.

So breathable penetrating sealers do effectively restrict and manage the formation of below surface efflorescence. Moreover they don't allow externally deposited soluble salts to be easily transported back into the stone or tile by way of evaporation even though they allow vapour transmission. However penetrating sealers are not coatings therefore they give no actual protection to the exposed surface. It is this fact that most influences the amount of damage externally deposited soluble salts can cause.

Let's look at an example. I have seen a number of sandstone installations near the ocean damaged by airborne soluble salt even after they have been sealed. The reason for this has nothing to do with a breathable sealer allowing soluble salt to move back into the stone as water vapour. What happens in the case of sandstone is the salt lodges itself in the unprotected surface pores. During wetting and drying cycles it expands and contracts creating a shearing force. This force is easily accommodated by sandstone whose binder (the compound that binds the sand particles together) is silica. However when the sandstone has for example a much weaker calcite as a binder the force breaks the bond and in doing so delaminates the surface. What a good sealer can do on the calcite bound sandstone is reduce, not stop, the amount of water that enters the stone. But it does nothing as far as the amount of soluble salt that can re-crystallize cyclically on the surface. Therefore the sealer can only delay, not stop the eventual damage.

How then do you ensure a stone or tile surface is not damaged by external sources of soluble salt? The first step is to use a good sealer to reduce and manage the amount of water (hence salt) that can possibly enter the stone. This will help to ensure the force of evaporation is greater than that of the stone's natural ability to absorb salt. The sealer must be salt resistant. By this we mean that the sealer should not be easily broken down in a salt environment. The second and most important step is to use a stone or tile that is salt resistant or safe. In the case of sandstone this means using one that does not have calcite binding the sand particles. The simple specification of a stone category such as granite does not guarantee that a particular stone within the category will be salt safe. There are many stones sold commercially as granite that are not salt safe for example.

The final and third step is to regularly wash exterior surfaces exposed to airborne salt. This is common practice for example in counties where cars are regularly washed to remove the salt used to de-ice the roads even though the car bodies are zinc coated for protection. Unfortunately it is not common practice for exterior stone and tile installations.

In summary the bottom line is that good sealers do help protect stone and tile surfaces from both internal and external sources of soluble salt. However they cannot work alone. To avoid failures the installation must also use stone and tile that is salt safe and regular cleaning and maintenance.



#### Points for selling Aqua Mix Products:

The key Aqua Mix products here are Eff-Ex, NanoScrub and Phosphoric Acid Substitute for cleaning and all of our Penetrating Sealers for protection. In the very early stages of surface efflorescence NanoScrub works perfectly. Once the deposit gets heavier Eff-Ex is the way to go and for even heavier deposits Phosphoric Acid Substitute may be required (as long as the stone and installation is not acid sensitive). In all cases the use of Eff- Ex as an inhibitor is recommended after cleaning.

As far as the sealers are concerned all of them will work in reducing the amount of water that penetrates the porous tile or stone surface. However for this express purpose I find Ultra Solv works the best on denser stone or tile and Sealers Choice Gold on the more porous surfaces.

## Job Site News:

Here is an email from one of Ian Taylor's customers (Aqua Mix distributor UK) highlighting the success he had using Aqua Mix Ex-Treme, NanoScrub and Eff-Ex on old quarry tile. I think you will agree the results are fantastic!

From: Chris Davis [<mailto:chrisdavis1969@sky.com>]  
Sent: 11 September 2008 14:20  
To: Ian Taylor  
Subject: Ex-Treme

Ian,

Just thought you might like to see these photos, it's the first time I've gone to Ex-Treme due to the level of in ground dirt. They don't really do justice to how the filthy the tiles were, or how clean they now look, but it's an interesting comparison.

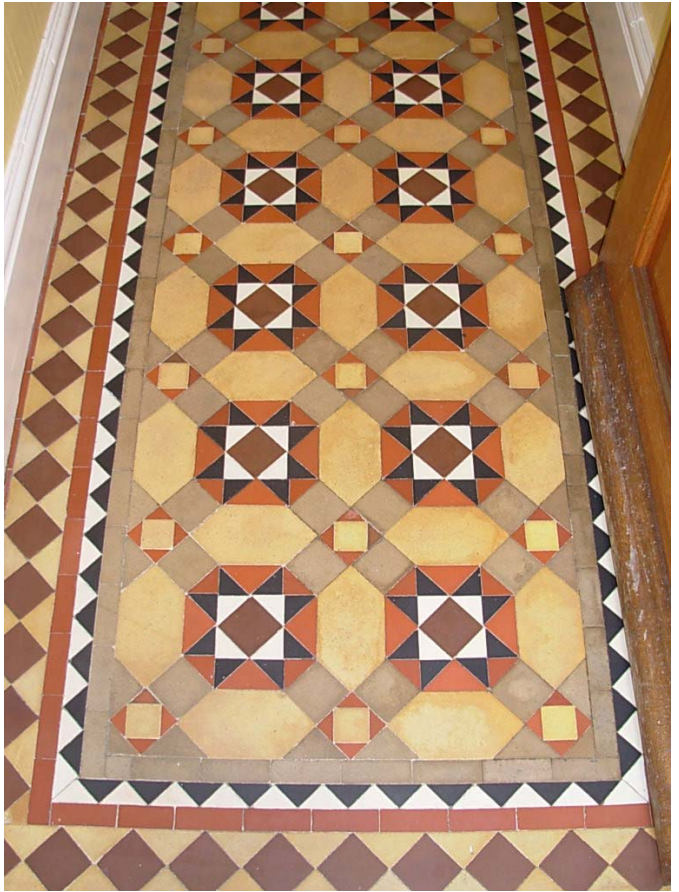
This 100 year old floor was so filthy with in ground dirt and wear that the customer had considered screeding over it and carpeting. It had been a student rental property for the previous 20 years, and had been seriously neglected. So on this floor I used a combination of Ex-Treme and Nano-Scrub with a low rpm scrubbing machine. The Ex-Treme was used in a 1:1 ratio with water and given 20 minutes dwell time. NanoScrub was then added and the floor was scrubbed. Once rinsed down thoroughly it was left to dry for a day and then treated with Eff-Ex to remove some efflorescence that developed. These pictures were taken once sealed with Seal and Finish Low Sheen (but prior to being treated with Floor Shine and Hardener).

Chris



Before

After



Before

After