

# Basilisk info sheet no. 2

## Frost and de-icing resistance ER7

### Basilisk Liquid repair system ER7

Basilisk Liquid Repair System ER7 is a liquid repair solution for small, narrow cracks in concrete which cannot be sealed with a mortar. After application the liquid forms a gel which watertight seals the crack. The bacteria then convert the gel into limestone for a permanent seal. Because small cracks are sealed watertight, the frost resistance and durability of the structure increases considerably.

### Frost and de-icing salts

Concrete is an often used construction material for buildings and infrastructure. During its lifetime, the concrete construction is exposed to weather conditions year after year. Especially during winters frost can cause serious damages by crushing the concrete from the inside. In some climates frosting is also often accompanied by rainfalls which causes slipperiness and to treat this, often de-icing salts are used. The use of de-icing salts forms a serious complication for concrete. One of the characteristic damages of de-icing salts is the exfoliation of the surface layer (scaling). The question is if ER7 is resistant to frost- and de-icing damages and whether the presence of it has any (positive) effects on the formation of damage.

### Damages

To answer this, we first have to look at the damage mechanisms and what this means for the ER7 present in the crack of the concrete. For this we limit ourselves to only damages in already existing concrete because this is the application area of ER7.

### Frost damage

Frost damage is caused by the freezing of water on the surface of concrete structures saturated with water. When freezing, the water expands and this leads to a high pressure on the not yet frozen water inside. Eventually the concrete crushes from inside because of the pressure. However, applying ER7 ensures a decrease in the porosity of concrete and the cracks are sealed watertight so there will be no water penetration to saturate the concrete with water. This protects the concrete from frost damage as there is no possibility for water saturation.

### De-icing damage

De-icing salts particularly cause damage on the surface of concrete. By using de-icing salts, heat is extracted from the concrete on the outer layer. This results in temperature differences between the surface layer and the more deep laying layer. The deeper layer freezes afterwards and presses the surface layer away, which is called scaling. In such a freezing

period this phenomenon arises in a cycle and causes new damage over again, which is called freeze/thaw cycles. Yet when ER7 is applied, there is a significant increase observed in freeze/thaw resistance of concrete.

## Tests and results

Earlier tests have shown an increase in freeze/thaw resistance of nearly 50 % on concrete treated with ER7. The tests are done by checking the mass loss due to scaling. On the graph below, the results are shown of mass loss due to scaling up to 7 freeze/thaw cycles with de-icing salts of concrete treated with and without ER7 under the same conditions.

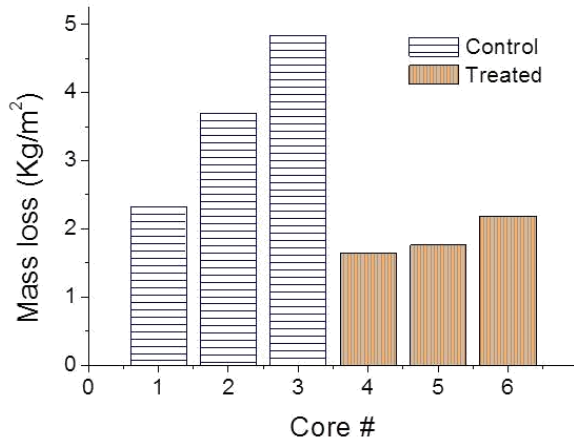


Figure 1 Results scaling of non- treated and treated cores<sup>1</sup>

The images below shows the results of the before and after 7 freeze/thaw cycles with de-icing salts of the untreated and treated concrete.

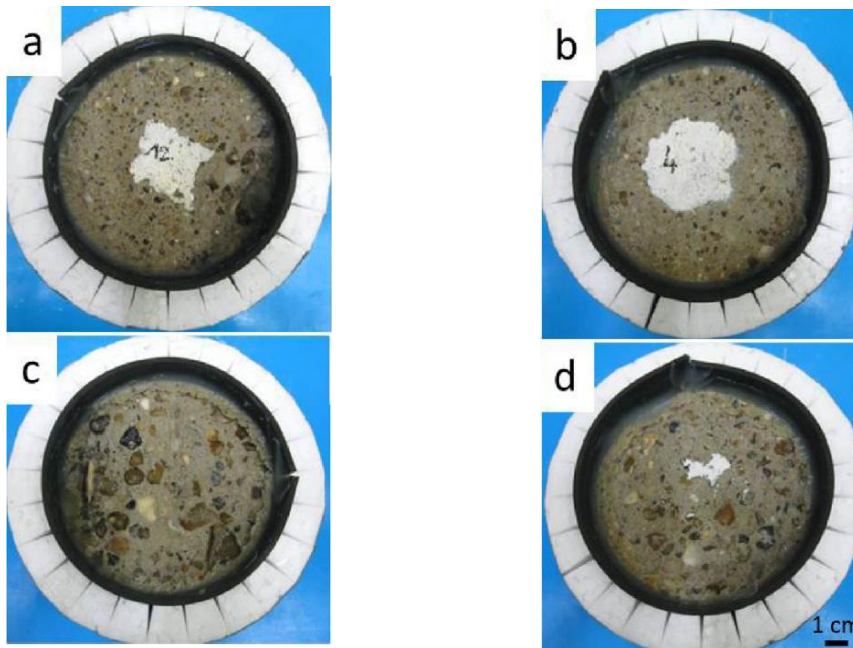


Figure 2 Control core #2 before and after 7 cycles<sup>1</sup> Figure 3 Treated core #5 before and after 7 cycles<sup>1</sup>

<sup>1</sup> Case studies in construction materials, V. Wiktor, H. M. Jonkers, January 2015

## Comparison

There are some other similar products on the market in the form of liquid repair systems, like crystalline products. However, these products are a coloured slurry membrane system which can only seal up to a crack width with a maximum of 0,4 mm, whereas ER7 can seal up to cracks of 0,8 mm width. Also the slurry has a different colour which gives an anaesthetic look, while the ER7 is no longer visible after the cleaning of excessive material. There is also not a released documentation of a (measurable) increase in freeze/thaw resistance of the concrete treated with the products.

Injections based on polyurethanes to prevent leakage is also an option, but this requires a lot of work and is quite costly.

Other polyurethane membrane (coating like) protections also only offer a crack sealing up to a maximum of 0,4 mm and requires a re-treatment every 7-10 years, while ER7 offers a permanent solution for static cracks and has a success rate in decreasing of leakages of 70-80 % and even up to no longer visible wet spots under the treated floors.

Another advantage of the ER7 is the rapid and easy application method. It can be applied with a handheld spraying unit, a roller or a machine. One day after the application the cleaning of excessive material takes place and the treated area is ready for use.

The self-healing repair solution is applied in liquid form as a two-component spray mixture. Basilisk Liquid Repair System is easy and quick to apply; 1.500 m<sup>2</sup> per hour is not uncommon. So compared to the lower-priced products, when considering the total picture, ER7 is more advantageous.

## Pricing

The pricing only based on the product may be slightly higher than some of the comparable products, but offers profit in application time and costs. Also the fact that it offers a permanent solution for static cracks, seals wider cracks and provides an autonomous healing of cracks after application weighs against the costs.

However, the price of ER7 compared to coating protections, which are often also used as aesthetic solutions, is very much lower. The price for injections is also much higher. Preferring ER7 to injections can save up to 5 times the costs for injections.

## Conclusion

To summarize, the presence of ER7 in concrete shows an significant increase in freeze/thaw resistance and prevents damages caused by frost and by measures taken for de-icing. Even though the price only based on the product is higher than some of the comparable products, it still has time and costs gain when also considered the application. The cracks treated do not need a re-treatment after a couple of years and are prevented from leakage.