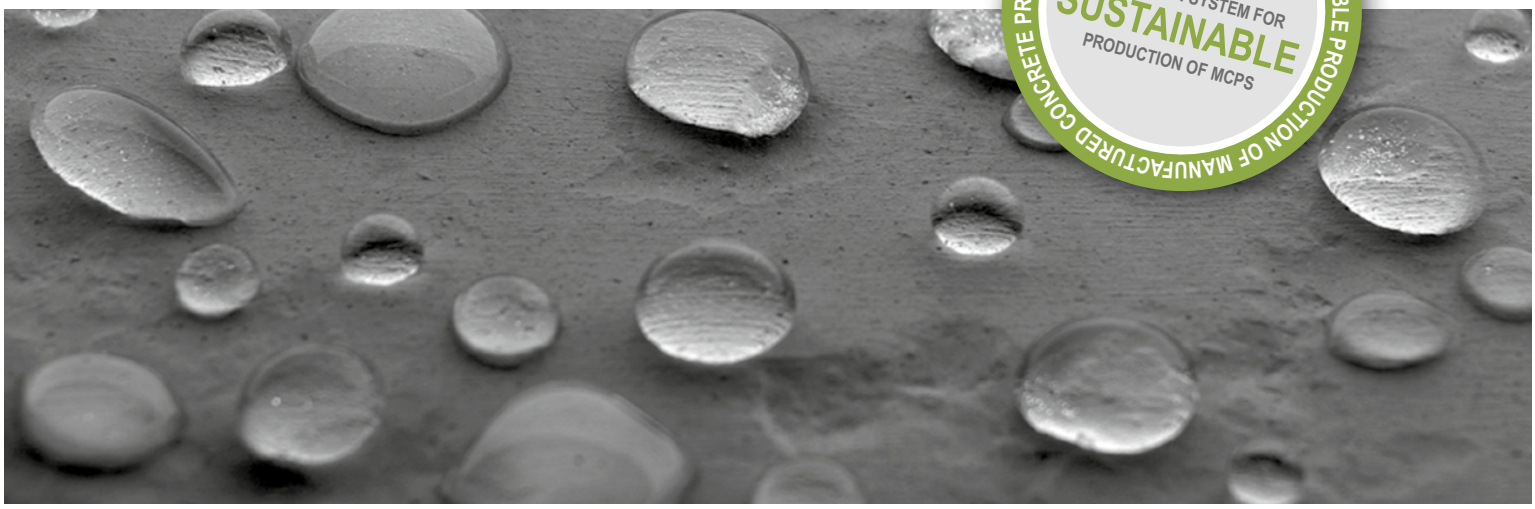
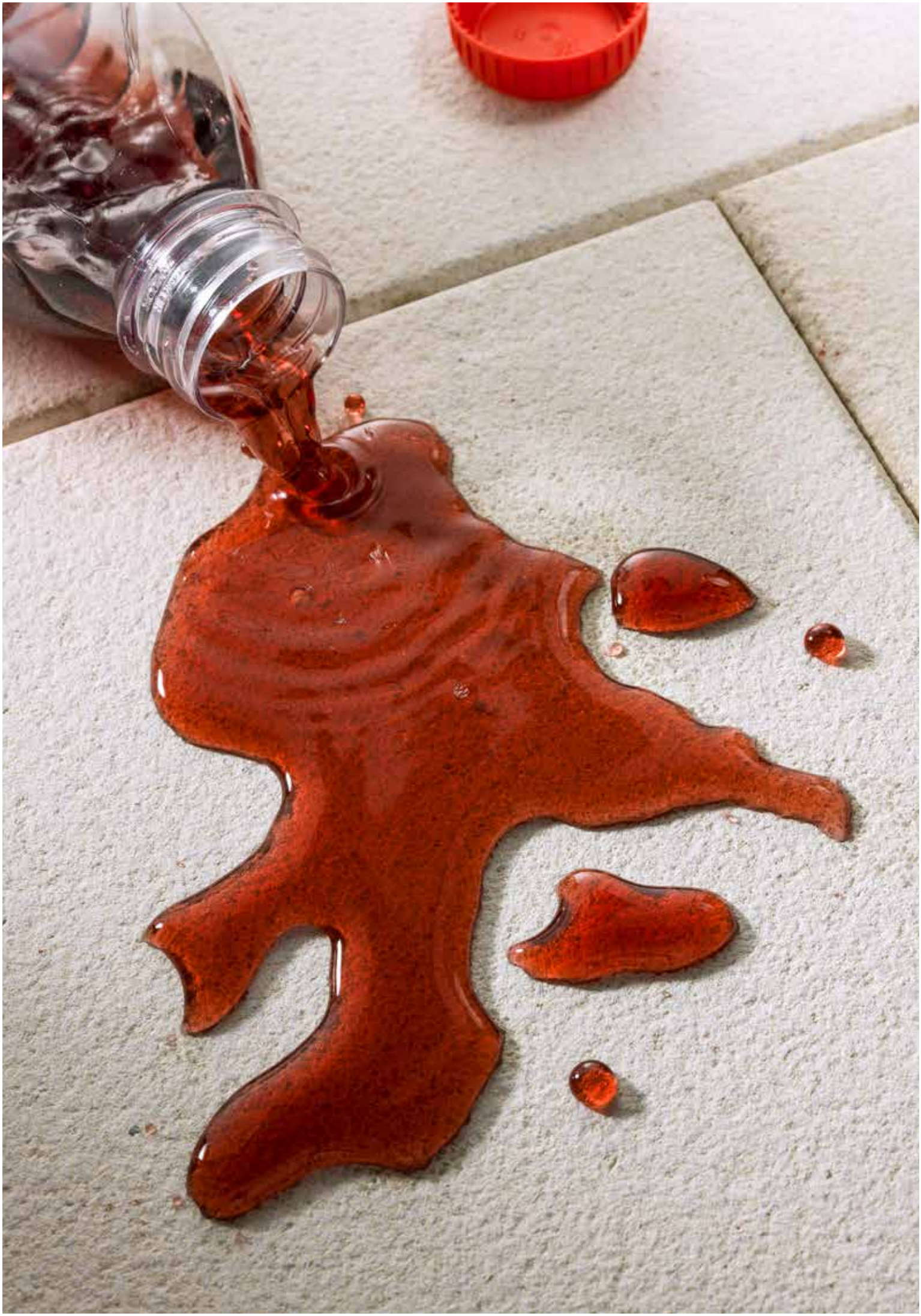
Ha-Be

Making good concrete better

HA-BE PROTECT

The surface protection system for manufactured concrete products





Ha-Be

Making good concrete better

Ha-Be's superhydrophobic technology for MCPs

FIVE-FOLD PROTECTION

Manufactured concrete products are expected to provide durable performance and long lasting aesthetical appearance. Damages and visual defects like spots, stains and efflorescence are therefore extremely inconvenient and can cause claims and cost consuming replacements. Preventive measurements are able to reduce that inconvenience simply because defects do not occur and replacements can be avoided.

To enable concrete producers, planners and municipal authorities to set new standards in private, commercial and public areas, Ha-Be designed the PROTECT – product line – a high performance surface protection system which shelters manufactured concrete products against strong soiling and defects e.g. from food, beverages, motor oil, water and weathering.

The Ha-Be PROTECT system works like a protective shield which restricts substances from penetrating into the concrete structure. Remaining on its surface, spots and soiling can be removed easily with water and a cleansing agent.

PROTECTS FROM EFFLORESCENCE

PROTECTS FROM WEATHERING

PROTECTS FROM FOOD & BEVERAGES

PROTECTS FROM WATER UPTAKE

PROTECTS FROM OIL

PHOTO: © ISTOCKPHOTO.COM/BIRDEYEISTOCK

Transferring the lotus effect to concrete

THE PRODUCT CONCEPT

Ha-Be designed the PROTECT System to preserve manufactured concrete products like paving stones, multi-layer and single-layer slabs from contaminations and efflorescence. It does not replace their cleaning but generates a certain water repellence and resistance against spots which simplifies the removal and keeps the manufactured concrete products attractive for a longer period of time. Therefore the PROTECT system retains the appearance and the value of these products in the long term.

HA-BE'S UNIQUE THREE STEP TECHNOLOGY

PROTECT is a holistic technological concept which combines three different steps into one Ha-Be PROTECT system:

Step 1: Optimizing the concrete microstructure
Step 2: Generating a hydrophobic structure
Step 3: Impregnation of the surface

Step 1

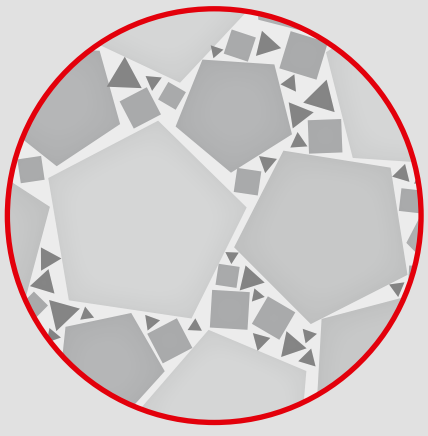
OPTIMIZING THE CONCRETE MICROSTRUCTURE

Surface protection develops its best results when including the mix design as one factor into the conception. Since porous concrete is prone to absorb water, the first objective is to create a dense microstructure. The key aspect is to minimize voids in the texture.

I order to allow for a minimum of voids in the concrete and thus achieve a closed concrete matrix, the packing density needs to be optimized by adjusting the grain size distribution, known as grading. An optimized grading ensures that the voids between the different sized aggregates are effectively filled by smaller particles. This can be further improved by adding supplementary fine materials, such as fly ash, or limestone powder.

Additionally, the density of concrete should be optimized by adding a plasticizer or superplasticizer to the concrete. The Ha-Be ANTIPOR plasticizers optimise the distribution of the cement particles – this allows better compaction of the concrete. The resulting densely packed microstructure provides higher compressive strength, an improved abrasion resistance a reduced water absorption.

CONCRETE MIXTURE BEFORE OPTIMIZATION



OPTIMIZED CONCRETE MIXTURE

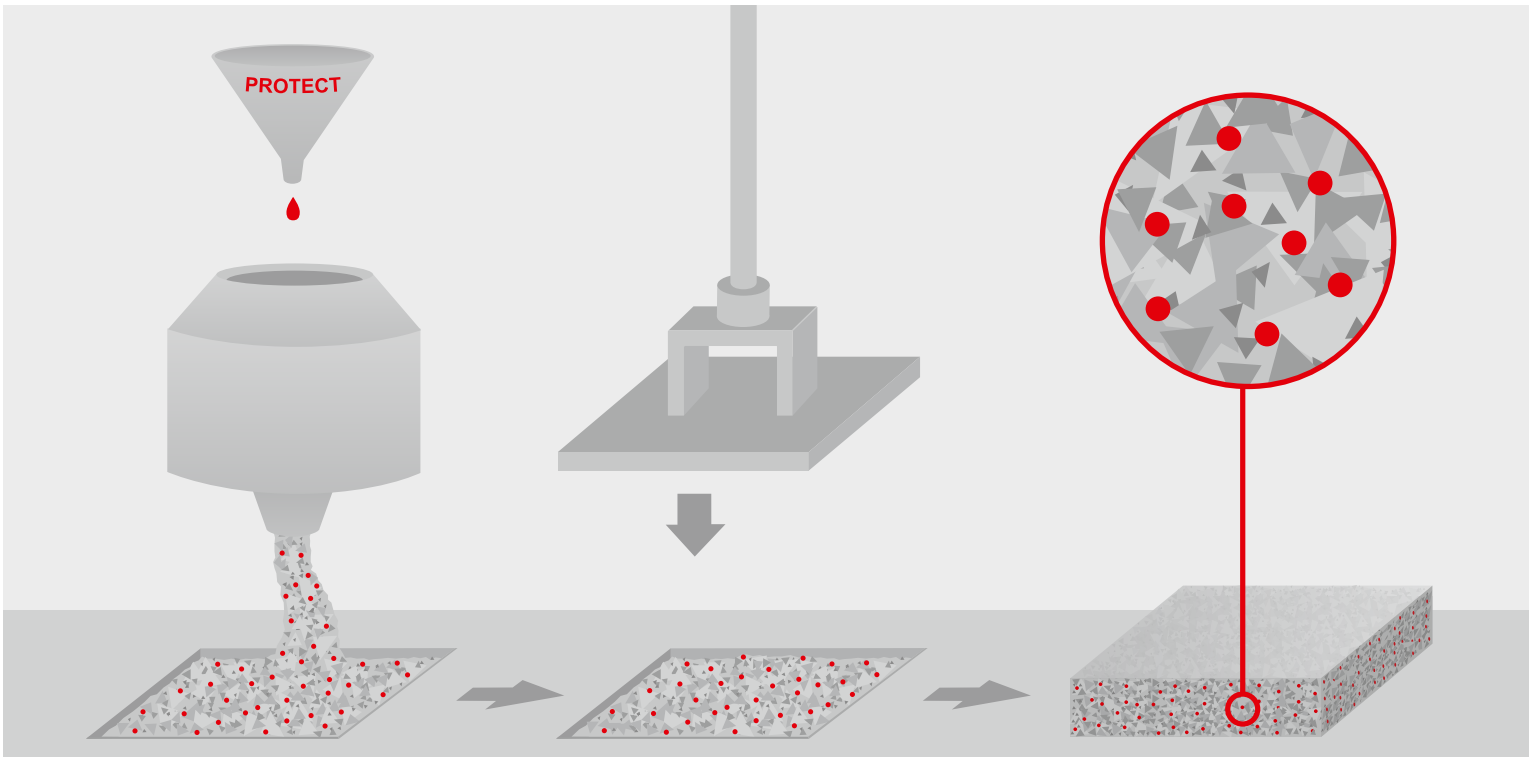
Step 2

GENERATING A HYDROPHOBIC STRUCTURE

Laid manufactured concrete products are likely to absorb water not only from the surface but from the bottom and the sides. In irrigation areas and maritime environments, water can seep thought the joints and enter into the concrete. Therefore, the PROTECT system is designed to provide water repellence to the entire concrete mass. This is realised by adding a hydrophobic admixture to the face and base concrete mix during its mixing process.

Hydrophobic admixtures consists of small molecules which are able to penetrate deeply into the capillary structure and chemically adhere to the inner pore walls. The achieved depth penetrating protection renders the construction material hydrophobic and consequently protects it from water absorption.

As a consequence of this, abrasion and mechanical loads do not reduce the protective mechanism. PROTECT hydrophobic admixtures are permeable to water vapour and retain the concrete surface appearance.



Step 3

IMPREGNATION OF THE SURFACE

In an additional third step an impregnation is applied to the surface of the manufactured concrete product. The impregnation on the concrete top gives extra-protection, which is important since most loads like food, beverages and oil attack concrete on the surface. PROTECT offers two different options, the filmforming impregnations (Coatings) and the transparent Impregnations (Non-film forming). Both products have similar protective features and can be applied either on the dry or the wet side of concrete production but their working principle and its appearance makes the difference.

OPTION A:
FILMFORMING IMPREGNATIONS (COATINGS)
The filmforming impregnations create a satin to glossy shining film which intensifies the original concrete colour. This film seals the capillary pores and protects from water and stain contamination.

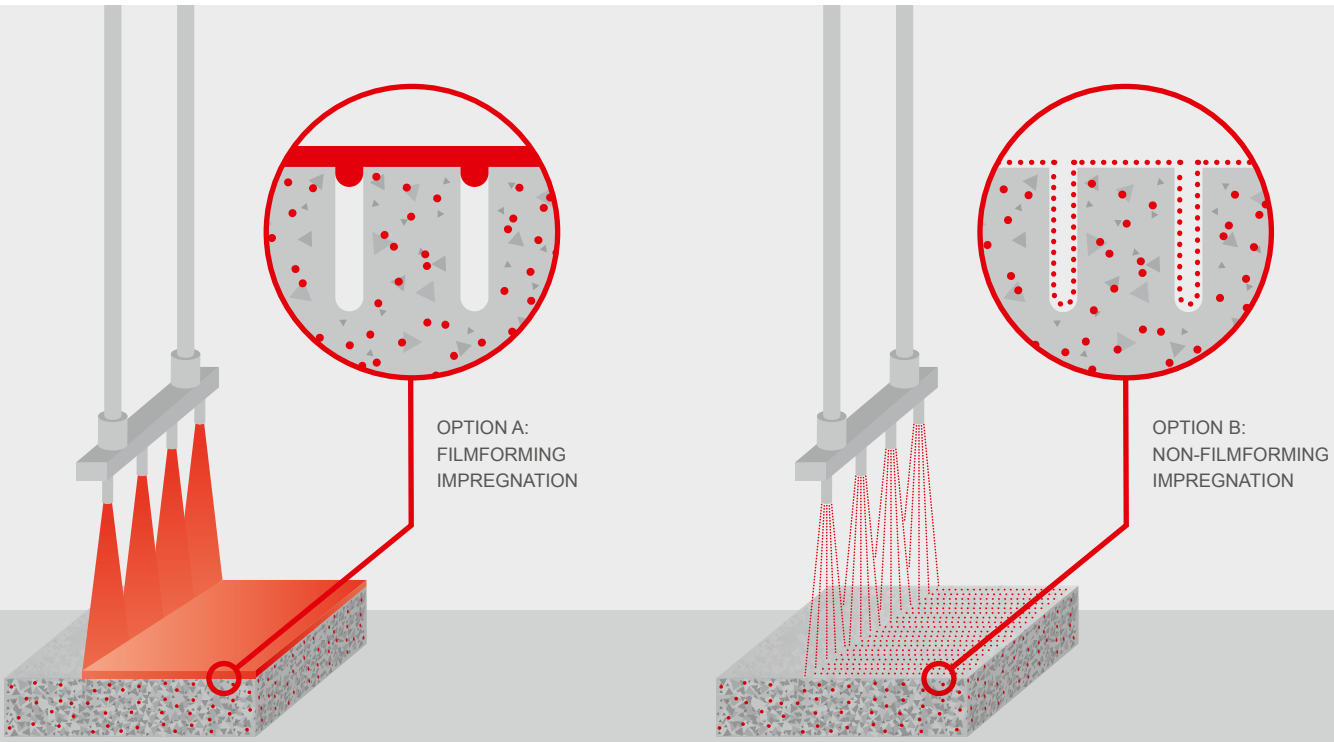
OPTION B:
TRANSPARENT IMPREGNATIONS (NON-FILM FORMING)
The non-film forming impregnations are invisible and retain the original appearance of the surface. Consisting of very small molecules, the transparent impregnations adhere chemically on the inner pore walls and render them hydrophobically. In consequence, liquids and contamination are repelled and cannot enter.

WITHOUT IMPREGNATION

WITH FILMFORMING IMPREGNATION

WITHOUT IMPREGNATION

WITH NON-FILMFORMING IMPREGNATION



Ha-Be surface protection system

FEATURES AT A GLANCE

PROTECTS FROM WATER ABSORPTION

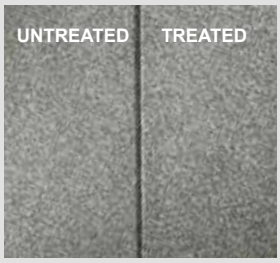
The assimilation of water is one of the major reasons of concrete damage and visual defects. Water penetrates into the concrete through the porous structure and is transported into the inside of the concrete product by the capillary suction of the surface. Due to this penetration, damages and visual defects like the occurrence of unattractive efflorescence often arise. To protect concrete from those effects, the key challenge is to prevent it from absorbing water.

The PROTECT system is especially developed for that purpose. It generates a hydrophobic concrete structure which stops the water absorption of manufactured concrete products.

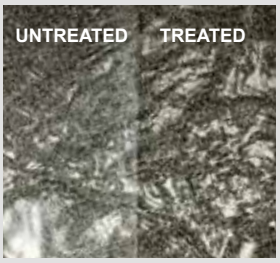
TWO SPECIMENS, THE ONE ABOVE UNTREATED, THE ONE BELOW PROTECT-TREATED,
THREE STEPS: DRY – WATER BATH – AFTER

PROTECTS FROM EFFLORESCENCE

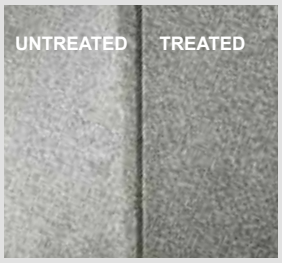
Efflorescence is a formation of salt deposits on or close to the concrete surface and appears usually as unattractive white discolouration. It mainly originates from the reaction of cement with water which releases a certain amount of calcium hydroxide. Dissolved in chemically or physically unsolved water, the hydroxide is transported to the surface. There it reacts with CO_2 from the ambient air to indissoluble calcium carbonate.
Slabs without any PROTECT treatment show clearly visible efflorescence. By contrast, the protected slab retains, even after 12 days in water bath, its attractive appearance and does not show any deposits.



BEFORE



IN WATER BATH



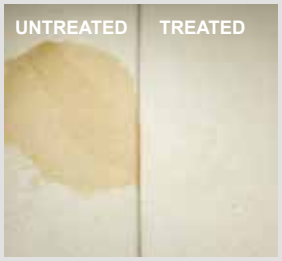
AFTER

PROTECTS FROM FOOD & BEVERAGES

PROTECT provides a protective mechanism which stops contaminations from penetrating immediately into the concrete structure and generates an ‘easy-to-clean’ effect. This means instead of entering, the substances render on the impregnated surface and can be cleared even after hours or days.
On protected slabs, food and beverages like red grape juice, coffee, vinegar and ketchup can be cleared without leaving any spots or stains. Unprotected concrete by contrast absorbs these substances and shows contaminations.

SPILLED COFFEE

CLEANING PROCESS



AFTER CLEANING

PROTECTS FROM OIL

In addition to the water repellent properties, PROTECT generates also an oleophobic effect. Oil and especially motor oil are very hard to clean once they have penetrated into the concrete structure. PROTECT restricts these substances from entering into the microstructure for a certain time and allow more time for removing the contaminating materials. Unprotected slabs and pavers, by contrast, show strong spots immediately after coming in contact with oil.

SPILLED OIL

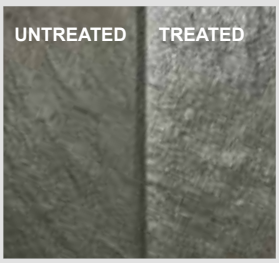
CLEANING PROCESS

AFTER CLEANING

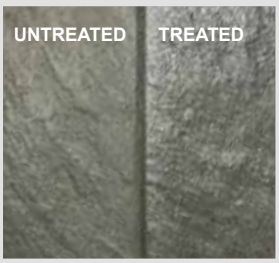
PROTECTS FROM WEATHERING

The natural weathering process like fading or vegetation growth decreases the aesthetic appearance of concrete surfaces. Certain resistance to the environmental conditions is therefore essential.

The effectiveness of PROTECT was examined in a weathering test. Therefore a PROTECT treated and an untreated specimen were exposed to the environmental loads for years. Analyses showed that the protected concrete retained its original colour brilliance and intensity while the unprotected one appeared faded.



START



AFTER 1 YEAR

AFTER 2 YEARS

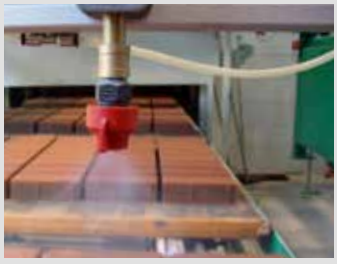
Ready – steady – go!

INDUSTRIAL APPLICATION OF PROTECT

The application of the PROTECT system can easily be incorporated into the existing production process – especially when choosing the dosing and spraying technologies of Ha-Be's subsidiary BM-Anlagenbau und Dosiertechnik GmbH: The hydrophobic admixture is dosed with a regular dispenser to the wet concrete.
The impregnations are sprayed to the concrete surface. The application method of the spraying system is selected depending on wether the slabs and pavers require further treatment or if they reached their final appearance right after leaving the mold. Should no further modification to the surface texture be desired, installation on either wet or dry side of the production is possible. If the product surface is to be modified by methods like shoot blasting, washing or polishing, the impregnation may be applied only the dry side of the production.

Spaying equipment for the wet side
The application on the wet side is done by spraying equipment. At this stage, the impregnation is sprayed on the concrete surface before the hydration process begins. Since the concrete product will remain in a curing chamber anyway, no additional drying equipment is required. The impregnation is completely hardened at the time that the concrete products are packed.

Spraying and drying systems for the dry side
Processed surfaces, instead, are treated with a spraying system on the dry side of the concrete production, directly after the products leave either the curing chamber or surface treatment process. The impregnation has to dry very fast in order to get the products ready for packaging. Since drying under normal conditions may require too much time, the process needs to be accelerated. Depending on the selected impregnation, the drying process can be realized either by infrared drying equipment (NIR technology) or with a closed UV-radiation system.



APPLICATION OF PROTECT
WITH SPRAYING EQUIPMENT

INFRARED DRYING EQUIPMENT
(NIR TECHNOLOGY)

UV- RADIATION SYSTEM
DRYING EQUIPMENT

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