

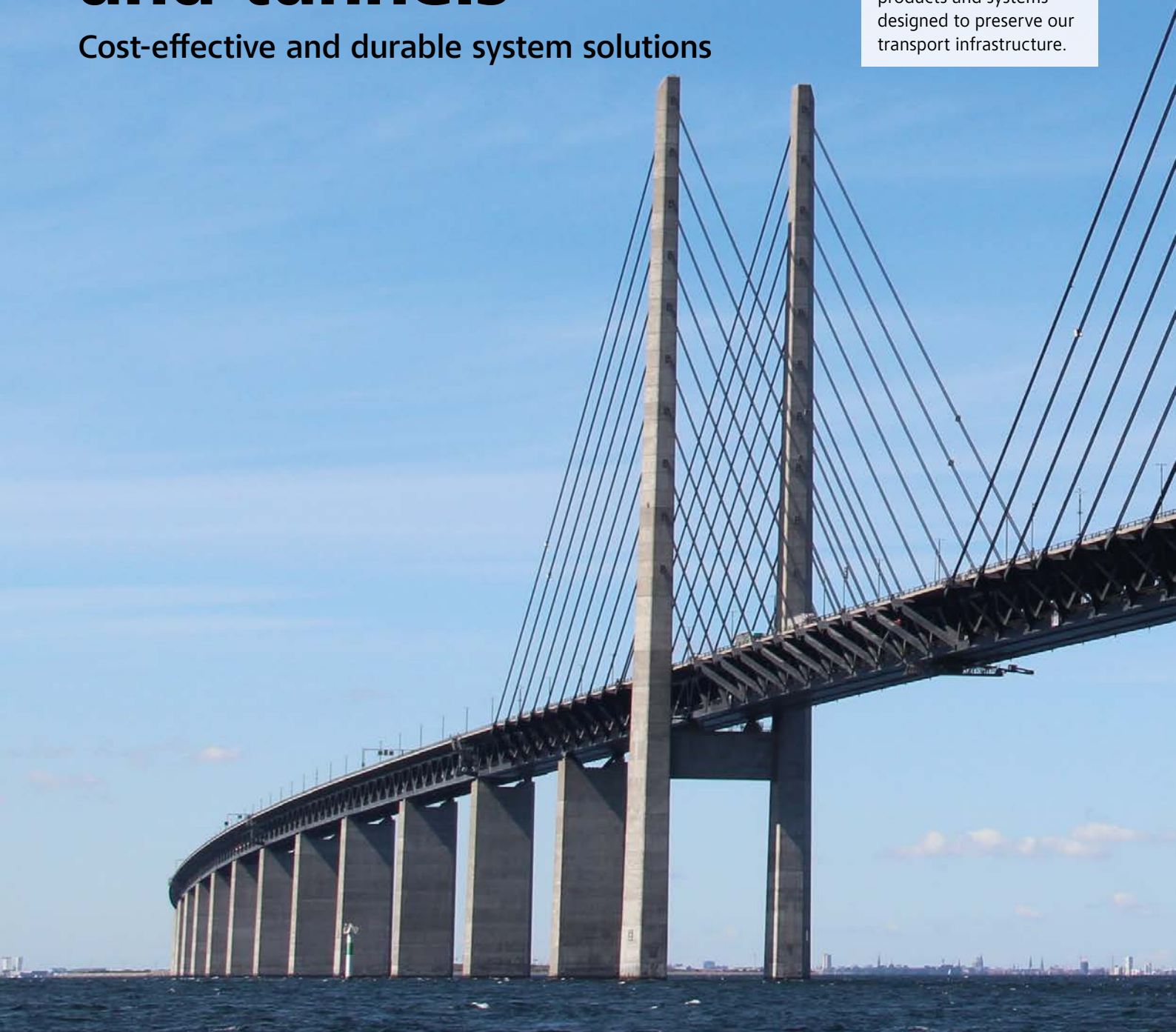
Repairing, reinforcing, and protecting bridges and tunnels

Cost-effective and durable system solutions

Concrete repair and concrete protection



The objective is to repair, reinforce, and protect bridges and tunnels made of reinforced concrete in a cost-effective and durable manner. To this end, we develop and produce high-quality products and systems designed to preserve our transport infrastructure.



Cover photo reference:

Øresund Bridge, Malmö, SE – Copenhagen DK

Photo: TobiasW/Adobe Stock

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Preserving our transport infrastructure

Intelligent, high-performance system solutions

One of our objectives is to repair, reinforce, and protect bridges and tunnels made of reinforced concrete in a cost-effective and durable manner. To this end, we develop and produce high-quality products and systems designed to preserve our transport infrastructure.

Our high-performance, deep-acting hydrophobic agent StoCryl HG 200 effectively protects the building fabric against water and harmful substances – as demonstrated by a long-term study that confirms its effective deep penetration.

What about strengthening bridges without changing their geometry? This is possible with modern materials such as CFRP plates.

Our StoPox TU 100 coating ensures increased safety in tunnels. Its excellent cleanability and maximum resistance to soiling also ensure lower maintenance costs in the long term, and protect the environment at the same time.

These and other system solutions for bridges and tunnels are presented in detail on the following pages. Our complete portfolio of products and systems can be found at www.stocretec.de. Please contact our qualified employees for personal specialist advice.

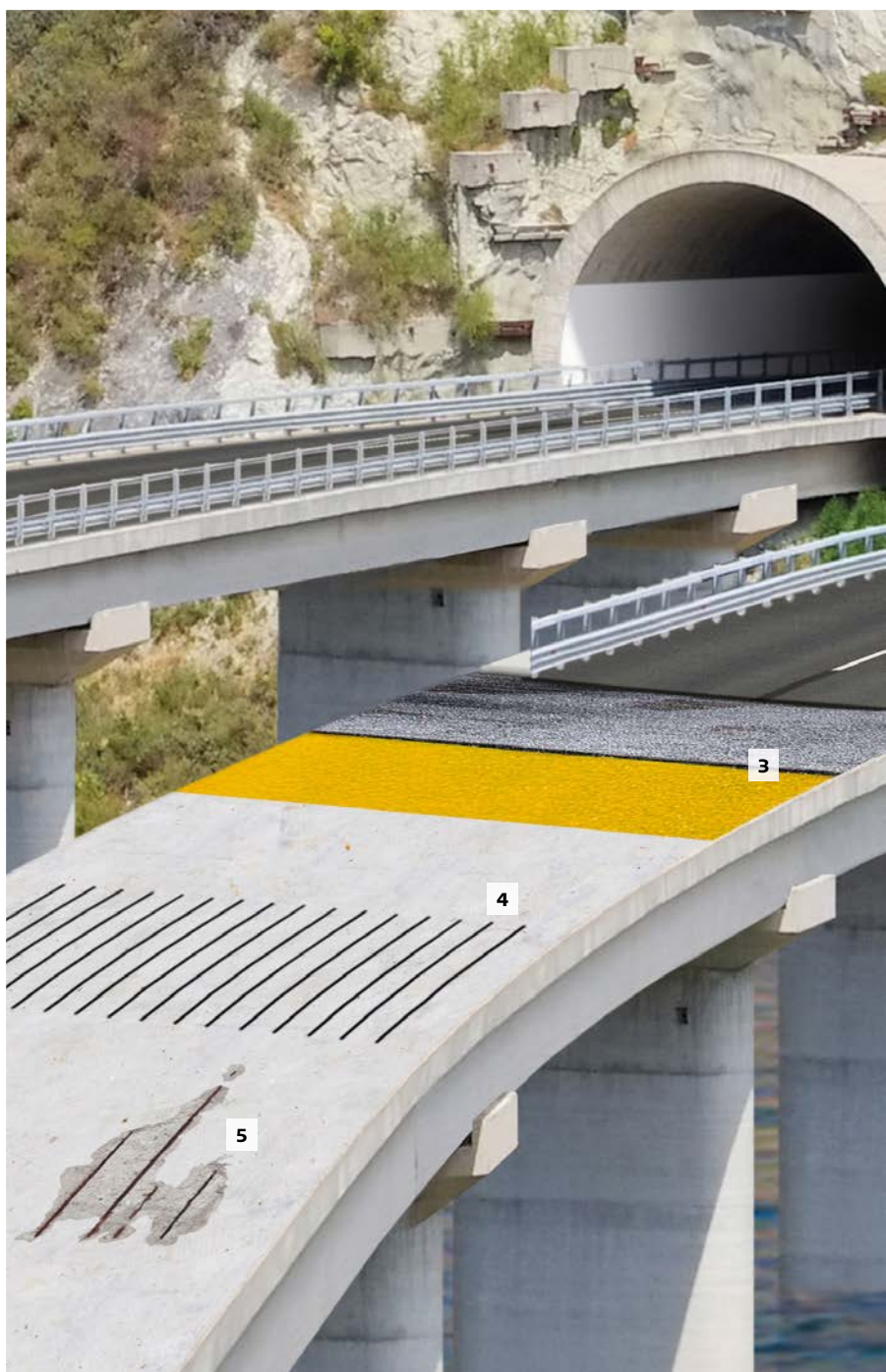


Photo: LianeM/Adobe Stock



1 Deep-acting hydrophobic agents: long-term protection for bridge edge beams with the StoConcrete Protect Hydrophobic system (see p. 6)

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Deep-acting hydrophobic agents with silane gel

Long-term studies confirm effectiveness and durability

StoCryl HG 200 protects reinforced concrete against the ingress of water and water-soluble harmful substances in a durable and effective manner. It therefore prevents damage caused by frost, chloride penetration, and chloride-induced steel corrosion, and significantly extends the service life of the construction.

The hydrophobic gel forms a protection layer with a thickness of several millimetres under the concrete surface. Compared to conventional hydrophobic impregnation, StoCryl HG 200 completely blocks the capillary absorption capacity of the porous concrete edge zone. This is made possible by the high depth of penetration of the active ingredient (around six millimetres). The concrete edge zone remains water vapour permeable.

The hydrophobic gel is based on long-chain silanes and the carrier material bentonite. This non-Newtonian fluid enables you to apply large amounts of material in one application cycle. Therefore, a large amount of active ingredient depot is deposited onto the building element surface. The interfacial tension between the silane and the water-logged pore wall actively transports the active ingredient into the concrete edge zone. The surface tension of the long-chain silanes changes very slowly, therefore enabling the active ingredient to penetrate the concrete edge zone over a long time and with a high depth of penetration.

As the gel penetrates into the concrete edge zone, the silanes react with the water that condenses on the pore walls.

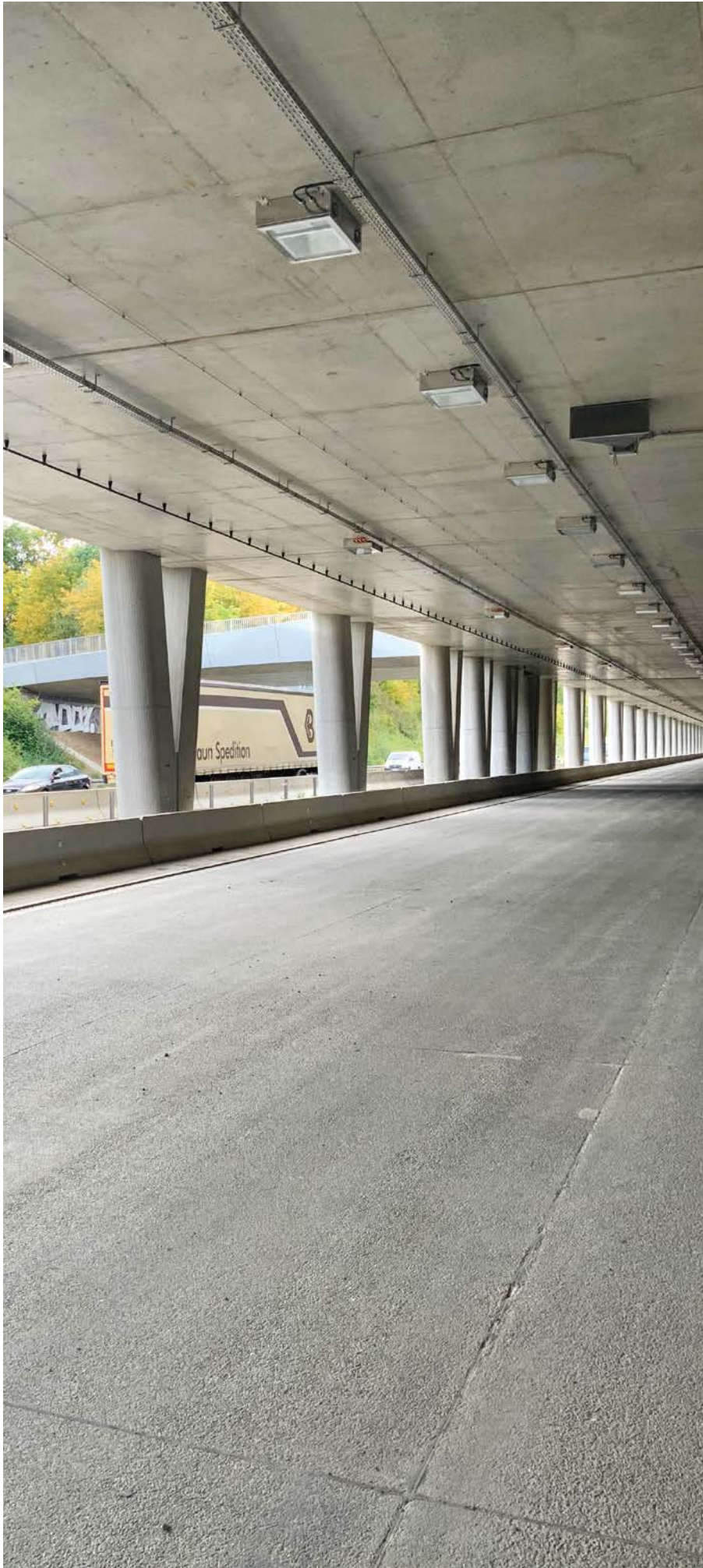
In a further reaction step, the silanols formed, cross-link with one another and with the hardened cement paste to form polysiloxanes. This results in a hydrophobic, chemically inseparable layer bonded to the cement, which prevents capillary absorption.



Flaking carrier material, bentonite, following application of the StoCryl HG 200 deep-acting hydrophobic agent

System StoConcrete Protect Hydrophobic

System products	Product description	Depth of penetration in accordance with EN 1504-2
StoCryl HG 200	Impregnation, hydrophobic, gel-like	Class II
StoCryl HC 100	Impregnation, hydrophobic, paste-form	Class II
StoCryl HP 100	Impregnation, hydrophobic	Class I
StoCryl GW 100	Impregnation, hydrophobic	Class I



A96 noise reduction structure, BW 159-1, Germering Süd, DE
StoCretec expertise: StoCryl HG 200

Field test confirms effectiveness

A field test carried out within the sphere of influence of the motorway authority for South Bavaria (Autobahndirektion Bayern Süd) has confirmed that the StoCryl HG 200 deep-acting hydrophobic agent provides highly effective, long-lasting concrete protection. For the purposes of the test, the deep-acting hydrophobic agent was applied to particularly exposed elements of eight existing bridges. The following aspects were studied over a period of 15 years:

- Active ingredient profile of the deep-acting hydrophobic agent
- Chloride penetration
- Carbonation speed

The results were as follows: the depth of chloride penetration was virtually unchanged. The carbonation speed slowed down. Water absorption continues to be prevented.

Conclusion: the deep-acting hydrophobic agent remains just as effective after 15 years and is preventing chloride from being absorbed into the concrete. The chloride front does not reach the reinforcing steel. In addition, the deep-acting hydrophobic agent slows down the carbonation speed. A sufficiently high depth of penetration is required in order to ensure effectiveness.

The field test proves that deep-acting hydrophobic agents are a sustainable way of extending the service life of concrete constructions without requiring repairs. Extensive studies on Swedish constructions indicate that deep-acting hydrophobic agents have a working life of up to 25 years.



Damp concrete surfaces dry quickly

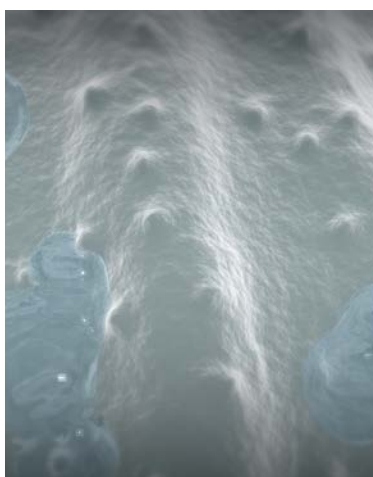
Dryonic Technology protects building fabric in the long term

The hydrophilic/hydrophobic structure of the biomimetic StoCryl V 700 coating ensures that concrete surfaces dry quickly. It therefore reduces stress caused by rain, fog, as well as spray and splash water. This provides the concrete with long-term protection, particularly against chlorides and other water-soluble harmful substances. In addition, StoCryl V 700 prevents the ingress of CO₂ and reduces costly repairs in the long term.

Dryonic Technology produces a coating surface with a microtexture made up of the clever architecture of binder and extender. This causes water to flow off quickly, leaving the surface to dry in a very short space of time. The water does not penetrate into the concrete, and the moisture contained in the concrete can diffuse more quickly.

The fog-basking beetle was the inspiration for this technology. Its carapace has a unique surface texture, consisting of countless microscopic bumps. Their hydrophilic tips condense the fog, while the hydrophobic dips between them rapidly convey the condensed water away.

StoCryl V 700 fulfills all the requirements according to EN 1504-2. It has a carbon dioxide-inhibiting effect, is water vapour permeable, and alkali-resistant. A wide range of colour shades offers numerous design possibilities.



Close-up image of the surface texture of the fog-basking beetle's carapace



StoCryl V 700 coating surface with microtexture

System StoConcrete Protect V

System products	Product description
StoCryl V 700	Coating, biomimetic function, matt
StoCryl V 100	Coating, mid sheen
StoCryl V 200	Coating, matt

In the system with

StoCryl GW 100	Impregnation, hydrophobic
StoCryl HP 100	Impregnation, hydrophobic
StoCryl HC 100	Impregnation, hydrophobic, paste-form
StoCrete TF 200	Fairing coat, layer thickness 2–5 mm
StoCrete TF 204	Fairing coat, layer thickness 1–3 mm

Reliably sealing bridge decks

Good tolerance to moisture:
special amine hardener reduces the formation of carbamate

The StoPox BV 100 primer, combined in the system with a bitumen sheet, seals bridge decks reliably and permanently – even under difficult conditions.

The hydrophobic epoxy resin has excellent early water resistance. Its hardener component – a pre-added amine – significantly reduces the formation of carbamate. The resin-hardener combination tolerates moisture and can therefore be applied to young concrete.

In addition to the standard ZTV-ING applications, StoPox BV 100 can even be used on fresh concrete. It simultaneously fulfills both curing and priming functions. The special hardener formulation also ensures better working conditions with less odour and a lower allergy potential.



Bridge sealing with StoPox BV 100 and bitumen sheet

System StoWaterproof Traffic Liquid BA 2000

System products	Product description	Material
StoPox BV 100	EP primer / EP sealer	Epoxy resin
Sto Zuschlag KS	Aggregate mixture for scratch coats	Quartz sands and extenders
StoPur VS 70	PUR bonding agent for StoPur BA 2000	Polyurethane resin
StoPur BA 2000	PUR spray-on waterproofing	PUR/PUA hybrid
StoPur VBS 2000	Tack coat between StoPur BA 2000 and mastic asphalt	Polyurethane resin



Reinforcement with CFRP plates

Cost-effective and resistant increase in traffic load for existing bridges

The Sto S&P CFK Lamelle, which is bonded in slots, is used to efficiently restore or increase the load-bearing capacity of existing bridges without substantial interventions in their building fabric. The plates are quick and easy to install – even in places which are difficult to access – and reduce weight restrictions, partial, or even complete closures. The load-bearing properties of the construction are restored or improved within a few days of application.

The CFRP plate consists of carbon fibre reinforced plastic (CFRP). It is bonded into prepared slots with an epoxy resin adhesive. As a result, the corrosion-resistant CFRP plate, which is insensitive to chlorides and carbonation, forms a force-transmitting and positive-locking bond with the building element. The bonding ensures a permanent transfer of the tensile stress, even under dynamic load.

The strengthening structure made of CFRP plates is visually inconspicuous. It does not influence the dead weight of the building element or the bridge's geometry. The CFRP plates can be cut to size on site and therefore flexibly adapted to the construction and the static requirements. Thanks to the protective coatings for concrete, it is possible to match the colour of the plates with the substrate. The reinforced areas can be combined with seals and carriageway coverings.

The structural calculation and assessment of the Sto S&P CFK Lamelle is carried out in accordance with the DAfStb (German Committee for Reinforced Concrete) guideline "Reinforcing concrete members with bonded reinforcement". In addition, the system has a national technical approval (aGB) from the Deutsches Institut für Bautechnik (German Institute of Building Technology). A bespoke software as well as the engineering department of Simpson Strong-Tie GmbH provide support for planning and structural calculation and assessment.

Image on right:
Sulzbachtal bridge,
Friedrichsthal, DE
StoCretec expertise:
StoConcrete Carbon
Plate

System StoConcrete Carbon Plate

System products	Product description	Application
Sto S&P CFK Lamelle	CFRP plate	Reinforcement bonded in slots
Sto S&P CFK Lamelle, low-modulus	CFRP plate type 150/2000	Superficially bonded reinforcement
StoPox SK 41	EP adhesive	Bonding CFRP composites
StoPox Mörtel standfest	EP mortar, layer thickness 4–20 mm	Levelling the substrate for subsequent structural strengthening
StoPox KSH thix	EP protection against corrosion and bonding agent	Protection against corrosion and bonding agent under StoPox Mörtel standfest



StoConcrete Carbon Plate

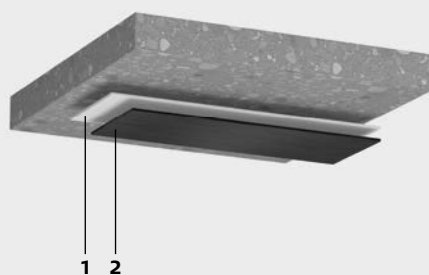
System advantages

- Cost-effective, efficient, discreet appearance
- System tested in line with building inspection requirements
- No significant impact on the existing architecture and minimal downtime
- High durability without material fatigue
- Low weight and easy application

Application

- Structural strengthening of concrete structures with bonded reinforcement
- Can be inserted in a slot or bonded on the surface

Build-up



- 1 — Adhesive
2 — CFRP plate



Outstanding performance in concrete repairs

Special fibres ensure safety in the event of fire

Virngrund tunnel, Ellenberg, DE
StoCretec expertise:
 StoConcrete Repair Prime TS 100,
 StoConcrete Protect Prime TU 100

StoCrete TS 100 is used to repair bridges and tunnels and to restore their load-bearing capacity. The class R4 polymer-modified dry-mix sprayed mortar is suitable for increasing concrete cover over large areas and for local reprofiling. It can even be applied and cured under dynamic load without any problems.

Due to its special formulation, StoCrete TS 100, bonded with the existing concrete, absorbs the stress and directs it into the substrate. Polypropylene fibres reinforce its fresh mortar structure and allow layer thicknesses of up to 50 mm in one application cycle. In the event of a fire, these fibres melt, thereby reducing the resulting vapour pressure and preventing the mortar from flaking. The fire tests according to the standard temperature-time curve, hydrocarbon curve, and the regulations for the equipment and operation of road tunnels (EBA) attest to its suitability for restoring the fire resistance of concrete members. It is classified in building material class A1 (non-combustible).

The polymers used for StoCrete TS 100 are highly resistant to frost/de-icing salt, chloride penetration, and carbonation. The mortar has proven to be extremely durable in the amphibious zone. It is therefore also suitable for areas that come into contact with water.

The application of StoCrete TS 100 using the dry spray process ensures a high degree of flexibility. The optimised mortar formulation enables it to be transported over long distances and significant differences in height from the material transfer to the application position. The mortar is available in silos.

StoCrete TS 100 fulfills the requirements in accordance with EN 1504-3. It also has test certificates for building technology issues.



Systems StoConcrete Repair and StoConcrete Screed

System products	Product description	Class
StoCrete TS 100	Dry-mix sprayed mortar, layer thickness of 6 – 50 mm	R4
StoCrete TS 136	Dry-mix sprayed concrete, layer thickness 15 – 60 mm, optimised for low-strength concrete	R3
StoCrete TS 126	Dry-mix sprayed concrete, layer thickness 15 – 60 mm, optimised for low-strength concrete	R2
StoCrete TG 203	Repair mortar, layer thickness 6 – 30 mm	R4
StoPox Mörtel standfest	EP mortar, layer thickness 4 – 20 mm	R3
StoCrete TG 114	Screed material, layer thickness 10 – 40 mm	R4
StoCrete TG 118	Screed material, layer thickness 20 – 100 mm	R4

Permanent sealing of cracks in concrete members

Resins for flexible or force-transmitting filling

Our injection resins restore the stability of bridges and tunnels quickly and in a cost-effective manner. They permanently seal cracks against water and corrosion-inducing chlorides dissolved in water, thus extending the service life of the construction.

StoJet PIH 200 is designed for the flexible filling of dry, damp, and water-conducting cracks. The polyurethane resin absorbs vibrations and the resulting crack movements. The resin's low viscosity enables a high depth of penetration resulting in an effective sealing layer. Furthermore, StoJet PIH 200 also has a particularly low surface tension. The interfacial tension between the polyurethane and the damp crack sides actively transports the injection resin into the crack.

A pre-injection with StoJet PU VH 200 must be carried out in water-conducting cracks. Upon contact with water, it forms a compact, stable foam within seconds, which immediately stops the water flow.

The StoJet IHS 93 injection resin bonds crack sides in a force-transmitting manner thanks to its high depth of penetration and tensile strength. The building element's rigidity is returned to its original state, so it can absorb loads again without any problems. The low-viscosity StoJet IHS 93 is also suitable for very fine cracks down to 0.1 millimetres on account of its excellent capillary activity.

Our injection resins fulfil the high requirements of European and national regulations. Their excellent injection behaviour was demonstrated under realistic conditions on a large beam.



Injection resins seal cracks and in doing so restore the stability of the construction.

System StoConcrete Inject

System products	Product description	Binder
StoJet PIH 200	Injection resin for flexible crack waterproofing	Polyurethane resin
StoJet PU VH 200	Injection resin for pre-injection in water-conducting cracks	Polyurethane resin
StoJet IHS 93	Injection resin for force-transmitting filling	Epoxy resin



Tunnel coating: cost-effective and durable

Excellent cleanability and maximum resistance to soiling

Our StoPox TU 100 coating ensures a higher degree of safety in tunnels thanks to its bright, non-reflective surface. Its optimised surface properties also ensure excellent cleanability – highest score according to EN 11998 – and maximum resistance to soiling.

The water-based epoxy resin therefore extends the cleaning intervals and reduces closure times for tunnels. It also decreases the amount of water used per cleaning operation. Chemical cleaning agents are not required.

StoPox TU 100 meets the requirements of an anti-graffiti system (AGS 1) in accordance with the TL/TP-ING issued by the Federal Highway Research Institute. The coating build-up is mechanically durable, carbon dioxide-inhibiting, and water vapour permeable. It protects the building fabric

against exhaust gas and water-soluble harmful substances on a long-term basis. The resistance of StoPox TU 100 to fuels has also been certified. Furthermore, the tunnel system fulfills the requirements of class B – s1, d0 – limited combustibility.

StoPox TU 100 is used in a wide range of system variants in new buildings and repairs – with and without mineral fairing coats. A further variant has been developed for load-bearing and compatible existing coatings. This eliminates the costly and time-consuming removal of old coatings.

In comparison with other tunnel coatings, StoPox TU 100 achieved the best results with regard to cleanability, susceptibility to soiling, and mechanical durability. Applications in various tunnels have confirmed its outstanding properties.

Image on right:
**Ursulaberg tunnel,
Pfullingen, DE**
StoCretec expertise:
StoConcrete Protect
Prime TU 100

StoConcrete Protect tunnel coating systems

System	System products	Product description	System application
StoConcrete Protect Prime TU 100	StoPox TU 100 StoCrete TF 204	Water-based epoxy resin coating Mineral fairing coat	OS-C (OS 4)
StoConcrete Protect Classic TU 100	StoPox TU 100 StoCryl GW 100	Water-based epoxy resin coating Hydrophobic primer	OS-B (OS 2)
StoConcrete Protect Reno TU 100	StoPox TU 100 StoPox WB 50 StoPox WG 100	Water-based epoxy resin coating Water-based epoxy resin filler (optional) Water-based epoxy resin primer	Reconditioning coat



StoConcrete Protect Prime TU 100

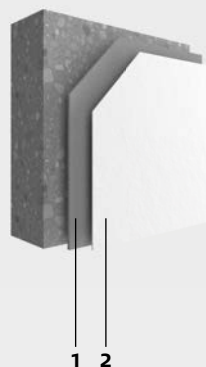
System advantages

- Maximum resistance to soiling
- Very good cleanability even without an additional cleaning agent
- High mechanical durability
- Optimised light reflexion coefficient and gloss level
- High resistance to alkalis, hydrocarbons, and petrols

Application

- Protection and visual design of tunnel linings
- On vertical and sloping surfaces
- For surface levelling and sealing blow-holes and pores

Build-up



- 1 — Fairing coat
- 2 — Coating

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