

# Lasting repair of existing concrete

Concrete repair products for building engineering, traffic structure engineering, hydraulic engineering, and drainage construction

Concrete repair and concrete protection



Mortar

The purpose of repairing buildings or structures made of existing concrete is to extend their remaining useful life. This is where we recommend our integrated solution concept. From the actual concrete repair product and fairing coat to the coating, all our concrete repair products are matched to each other. You will get everything from a single source.

Cover photo:

**Marien cathedral, Velbert-Neuiges, DE**

**StoCretec expertise: StoConcrete Repair Prime TS 100**

Photo: Martin Baitinger

It should be noted that the details, illustrations, general technical information, and drawings contained in this brochure are only general proposals and details which describe the functions. They are not dimensionally accurate. The applicator/customer is independently responsible for determining their suitability and completeness for the construction project in question. Neighbouring works are only described schematically. All specifications and information must be adjusted or agreed in the light of local conditions and do not constitute work, detail or installation plans. The technical specifications and information on the products contained in the Technical Data Sheets and system descriptions/approvals must be observed.

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# Repairing buildings made of existing concrete

## Extending their remaining useful life, preserving history

Sustainability is one of the key guiding principles for the future. Based on the results of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992, the German government developed the “Sustainable Building” guideline in 2001. When the guideline was updated in 2013, repair was included in Part D – “Refurbishment of Buildings” for the first time. A sustainable approach means taking account of the three dimensions of sustainability – ecology, economy, social culture – simultaneously and in equal measure. The goal is to be able to leave behind a pristine environment and the same life opportunities for generations to come.

The purpose of repairing concrete buildings and structures is to extend their remaining useful life. This task represents minimally invasive work on the building or structure in which only the material that absolutely needs replacing is removed and replaced. This means that all parties involved in the project – the operator, planner, applicator, and material supplier – contribute to the preservation of natural resources.

Lots of sophisticated buildings and structures are made from concrete, reinforced concrete, or prestressed concrete, for example reservoir dams, bridges, tunnels, or building engineering projects. The structures and building elements have to fulfil different functions at the same time, whether this relates to structural integrity, fire protection, or their aesthetic appeal. Depending on the type of use, stress during the use phase, location, etc., these structures are exposed to impacts. This causes degradation of the existing level of resistance of the building material that has been used. If the actual condition of the structure or building element deviates so much from its intended condition that it has reached the end of its remaining useful life, a concrete repair is required.



**Alb Dam, Laufenburg, DE**

StoCretec expertise: StoConcrete Repair Prime TS 126

Photo: StoCretec GmbH

# Monolithic versus multilayer model

## Regulations and their requirements for suitable concrete repair products

The requirements for the durability of reinforced concrete structures are defined in DIN EN 1992 (EC2). They are important for the technical implementation of a repair. The requirements for an appropriately durable load-bearing structure are met if this structure fulfils its function in relation to load-bearing capacity and serviceability during the intended remaining useful life without any significant loss of its functional properties, with an appropriate outlay on maintenance.

It is important to make sure the appropriate model is used. The monolithic model should be used for new buildings and structures. This is where a building element is made entirely from just one concrete. By contrast, concrete repair is based on the multilayer model. A concrete repair product is applied to the prepared concrete substrate. This multilayer system needs to work in combination

and withstand the effects from the surrounding environment and substrate over the long term. There can be no incompatibility.

Any stresses that occur in the concrete repair product must be safely introduced into the concrete substrate. This can be done by reinforcing and anchoring the concrete repair product back into the substrate or by adhesively bonding the concrete repair product to the prepared concrete substrate. This back-anchoring secures the permanent bond mechanically. By contrast, the adhesive bond is a consequence of the chemical reaction between the cement and the water in the concrete repair product. Physical gripping of the growing C-S-H phases takes place in the blasted concrete substrate.



**Marien cathedral,  
Velbert-Neuiges, DE**  
StoCretec expertise:  
StoConcrete Repair  
Prime TS 100  
Photo: Natascha Stockhausen



## Classification of the existing concrete in the area of the repair level\*

Existing concrete class	Compressive strength <sup>1)</sup>	Surface tensile strength <sup>2)</sup>	
		Average value	Lowest single value
	[MPa]	[MPa]	[MPa]
A1 <sup>3)</sup>	≤ 10	< 0.8	< 0.5
A2	> 10	≥ 0.8	≥ 0.5
A3	> 20	≥ 1.2	≥ 0.8
A4	> 30	≥ 1.5	≥ 1.0
A5	> 75	≥ 2.5	≥ 2.0

\*Technical Rule "Maintenance of Concrete Structures" – Part 1

<sup>1)</sup> Average value of the compressive strength (calculated according to DIN EN 12504-1)

<sup>2)</sup> Lowest single value/average value (calculated according to DIN EN 1542)

<sup>3)</sup> The Technical Rule does not contain any definitive regulations on the existing concrete class A1.

During the use phase of the structure, cracks in the concrete repair product or cavities between the concrete repair product and substrate can occur with an adhesive bond. A major cause of this is a failure to maintain mechanical compatibility for the large-scale concrete repair. The concrete repair product applied over a large area must not hinder the deformation of the building element and must not build up any residual stresses from shrinkage. There is a risk of overloading the bond level between the concrete substrate and the concrete repair product. The following rule also applies to repairs: the multilayer system must become softer towards the outside, described by the modulus of elasticity.

Specific properties of the concrete repair product, e. g. its modulus of elasticity, must be matched to the concrete substrate. The Technical Rule "Maintenance of Concrete Structures" classifies the concrete substrate into existing concrete classes A1 to A5. The compressive strength and the bond strength of the existing concrete drop from A5 to A1. On this basis, requirements are set for concrete repair products for the respective existing concrete class in order to guarantee a concrete repair that will last. The European standard EN 1504 Part 3 classifies mortars and concretes used for repair into R classes (R1 to R4). The compressive strength and modulus of elasticity of the concrete repair product decline from R4 to R1. This reflects the reduced strength of the concrete substrate.



**Fuchsbau, Munich, DE**  
StoCretec expertise: StoConcrete Repair Prime TG 203  
Photo: Isabell Munck

# Building inspection requirements for fire protection

Safety fully guaranteed in the event of a fire

If there is a fire, the stability of a building or structure must be guaranteed for a specified minimum period. The aim is to protect human life and health as well as material assets. When it comes to structural fire protection, a distinction is made between the way that building materials react to fire and the fire resistance of building elements.

## Building materials class

In terms of their reaction to fire, building materials can be classified into building material classes in accordance with DIN 4102-1 or EN 13501-1. For example, the “non-combustible building materials” are assigned to building material classes A1 and A2 in accordance with DIN 4102-1. According to EN 13501-1, classes A1 and A2-s1, d0 meet the building inspection requirement “non-combustible”.

## Fire resistance class

The fire protection classification of building elements into fire resistance classes in accordance with DIN 4102-2 and EN 13501-2 can be used as an alternative for verifying the required fire resistance period of a building element. For example, the building inspection requirement “fireproof” in accordance with DIN 4102-2 has the fire resistance class F90 assigned to it. In accordance with EN 13501-2, this corresponds to class R90 for load-bearing building elements without integrity. It should be noted that the classifications in accordance with DIN 4102 and EN 13501 are not directly transferable to one another.

## Fire curve

Proof of fire resistance can be provided using different fire curves. For example, the standard temperature-time curve (ETK) depicts a fire scenario in housing and residential construction.

**AURUM KCII,**  
**Cologne, DE**  
StoCretec expertise:  
StoConcrete Repair  
Prime TS 136  
Photo: StoCretec GmbH





# Integrated overall concept

Mechanical properties combined with high durability and fire protection

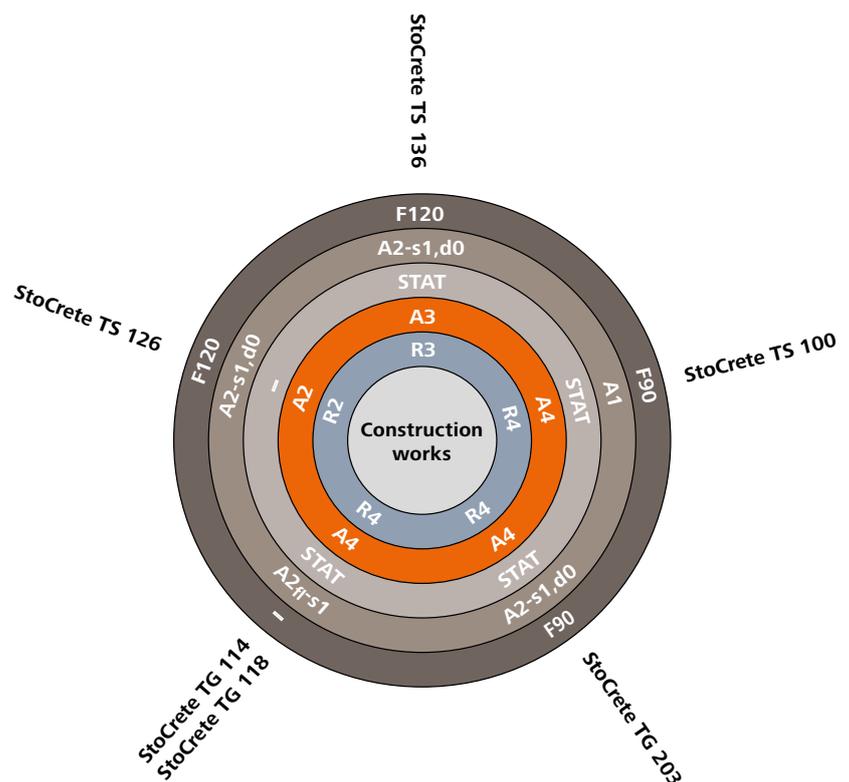
For stability-relevant and non-stability-relevant concrete repair, taking account of the present existing concrete class, we recommend our integrated solution concept. It combines the mechanical properties that are required for existing concrete with the high requirements that are placed on the durability of repair mortars and concretes. A key focus is on the interaction between the modulus of elasticity and shrinkage. The lower the modulus of elasticity, the higher the shrinkage can be. The higher the modulus of elasticity, the lower the shrinkage must be.

Our range for repairing existing concrete is used in a variety of market segments:

- Building engineering
- Civil engineering
- Hydraulic engineering
- Municipal wastewater treatment plants, etc.

Our overall concept enables the repair to be implemented appropriately based on the project, building element, position of the application surface, type of application, and the local conditions. The concrete repair products are matched to each other. They meet the requirements of the relevant classes R2 to R4 in accordance with EN 1504-3. This is documented by the declaration of performance and the associated CE marking according to the German Construction Products Regulation (Bauproduktenverordnung). Continuous quality control – comprising in-house and external monitoring – ensures that product quality remains consistently high. The test certificates for the building material class “non-combustible” and the fire resistance class complete the overall concept.

-  Fire resistance class
-  Building materials class
-  Structural contribution
-  Existing concrete class
-  R class in accordance with EN 1504-3



## System solutions – repair products for existing concrete

System	StoConcrete Repair Prime TS 126	StoConcrete Repair Prime TS 136	StoConcrete Repair Prime TS 100
<b>System description</b>	CEM repair system, polymer-modified, dry-mix process, low modulus of elasticity	CEM repair system, polymer-modified, dry-mix process, low modulus of elasticity	CEM repair system, polymer-modified, dry-mix process, statically active
<b>Product</b>	StoCrete TS 126	StoCrete TS 136	StoCrete TS 100
Position of the application surface	Vertical, overhead	Vertical, overhead	Vertical, overhead
Application	Dry-mix process	Dry-mix process	Dry-mix process
R class in accordance with EN 1504-3	R2	R3	R4
Existing concrete class	A2	A3	A4
Structural contribution		■	■
Building material class in accordance with EN 13501-1	A2-s1,d0	A2-s1,d0	A1
Fire resistance (standard temperature-time curve) in accordance with DIN 4102-2 <sup>1)</sup> and DIN EN 1365-2 <sup>2)</sup>	F120 <sup>2)</sup>	F120 <sup>2)</sup>	F90 <sup>1)</sup>
<b>Market segment*</b>			
Building engineering	■	■	■
Civil engineering	■	■	■
Hydraulic engineering	■	■	■

\* There should be a consultation on property-specific requirements.

## System solutions – repair products for existing concrete

System	StoConcrete Repair Prime TG 203	StoConcrete Screed Classic TG	
<b>System description</b>	CEM repair system, polymer-modified, manual or wet-mix process, statically active	CEM repair system, polymer-modified, manual, statically active	
<b>Product</b>	StoCrete TG 203	StoCrete TG 114	StoCrete TG 118
Position of the application surface	Any	Horizontal, slightly inclined	Horizontal, slightly inclined
Application	Manual, wet-mix process	Manual	Manual
R class in accordance with EN 1504-3	R4	R4	R4
Existing concrete class	A4	A4	A4
Structural contribution	■	■	■
Building material class in accordance with EN 13501-1	A2-s1,d0	A2 <sub>fl</sub> -s1	A2 <sub>fl</sub> -s1
Fire resistance (standard temperature-time curve) in accordance with DIN EN 1365-2	F90		
<b>Market segment*</b>			
Building engineering	■	■	■
Civil engineering	■	■	■
Hydraulic engineering	■		

\* There should be a consultation on property-specific requirements.



# Performance-demonstration concept

Extensive individual tests provide reassurance

The formulation of concretes in accordance with DIN EN 206-1 and DIN 1045-2 and sprayed concretes in accordance with DIN 18551 and DIN EN 14487 is based on the monolithic model. It has a long tradition and extensive experience from creating concrete members with and without reinforcement in new buildings. During any repair, these concretes may only be used in an adhesive bond indoors, protected from environmental influences. Otherwise, these products must be anchored back.

By contrast, the development of our concrete repair products is based on the multilayer model. They are designed to work constantly in an adhesive bond on the substrate concrete, well beyond the exposure classes for the interior of the building. Effects from the environment and the concrete substrate and the properties of the concrete substrate are taken into account.

The performance-demonstration concept comprises testing all the relevant effects individually before a product is marketed. This means that operators, planners, and applicators have the reassurance prior to installation that the multilayer system meets the requirements for durability in the use phase.

From the actual concrete repair product and fairing coat to the coating, all the concrete repair products are matched to each other.



**Sand trap, municipal wastewater treatment plant, Bonn-Beuel, DE**

StoCretec expertise: StoConcrete Repair Prime TS 136  
Photo: IBE-Ingenieure GmbH+Co. KG

Image on right:

**Iller bridge, Kronburg, DE**

StoCretec expertise: StoConcrete Repair system  
Photo: cityfoto24/Adobe Stock



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