

TOTAL CONCRETE REFURBISHMENT MANAGEMENT

BUILDING TRUST

TOTAL CONCRETE REFURBISHMENT MANAGEMENT

REINFORCED CONCRETE is the most widely used construction material in civil engineering. This composit material is valued for its compressive strength, availability, affordability, ease of use, and durability. However, despite these advantages, concrete has two major weaknesses – it is porous and prone to cracking. Over time, this allows contaminants to penetrate, leading to deterioration and steel reinforcement corrosion.

Traditionally, these issues are addressed with high-quality mix designs, sufficient reinforcement cover, and a high cement content.

Today, the operation of old deteriorating structures and the demand for more CO_2 reduced, durable, and leaner construction is driving the need for additional solutions. Sika offers a wide range of innovative solutions to extend the lifespan of structures, improve concrete quality and protect it, thereby reducing the need to demolish and rebuild structures that could be preserved. We categorize these solutions in four fields: corrosion, repair, strengthening and protecion management. Contact us, so we can help you to ensure the right solution is chosen for each project.



CORROSION MANAGEMENT
All reinforced concrete structures can crack and may suffer damage or deterioration at some stage during their lifespan. Sika's Total Corrosion Management System offers an effective and complete range of corrosion protection solutions to prevent damage and extend the service life of concrete structures.

- Cathodic Protection
- Passive Inhibitor



REPAIR MANAGEMENT
In some cases, when reinforced concrete deterioration – whether due to corrosion, chemical degradation, erosion, or other factors – is already advanced, intensive repair work may be necessary. Sika's Repair Management concept offers a comprehensive range of materials for durable concrete restoration.

- Steel Bar Protection
- Structural Repair Mortars
- Resurfacing Mortars
- Crack Injection
- Joint Sealing and Waterproofing



STRENGTHENING MANAGEMENT
When corrosion significantly impacts internal steel reinforcement, or when fatigue or structural overload compromises structural integrity, implementing strengthening measures becomes essential. Sika's Strengthening Management concept offers comprehensive solutions and advanced calculation tools, tailored to meet all structural strengthening requirements.

- Flexural Strengthening
- Confinement
- Shear Strengthening
- Deflection Reduction
- Active Strengthening



PROTECTION MANAGEMENT
Once the necessary renovation, strengthening and corrosion management works are completed, future interventions must be prevented. Protecting the concrete from contamination and the penetration of harmful elements will significantly reduce future deterioration, improve the appearance and help prolong the structure's design life.
Sika's Protection Management offers a comprehensive range of concrete protection solutions from invisible impregnations to crack- bridging coating systems.

- Hydrophobic Impregnation
- Protective Coating

CORROSION MANAGEMENT

All reinforced concrete structures can suffer from damage and deterioration at some stages during their life span. Total Corrosion Management Systems from Sika encompasses an effective range of complete corrosion protection solutions.

- Cathodic Protection
- Passive Corrosion Inhibitor
- Active Corrosion Inhibitor

EN 1504-9 defines the principles and methods that are used to carry out refurbishment of concrete structures. While the principles 1 to 6 relate to defect in the concrete, principles 7 to 11 deal with issues related to reinforcing bars.



This images shows chloride induced pitting corrosion.

CORROSION INHIBITORS:
Surface-applied corrosion inhibitors follow Principle 8 (increasing resistivity) and Principle 11 (Control of anodic areas) as recommended by EN 1504-9. Different corrosion inhibitors may be used.

Dual functional Inhibitor:
The highest level of protection is achieved through the dual functionality of the surface-applied corrosion inhibitor. The first function is to keep the concrete dry. When moisture content drops below a certain threshold, corrosion is significantly reduced, even in chloride-contaminated or carbonated concrete. The secondary function is activated when humidity infiltrates the concrete nevertheless, such as through cracks that have developed over time. At this point, the latent corrosion inhibitors in the formula are activated and protect the steel reinforcement despite the cracks. This high-performance dual phase protection works in case of both carbonated as well as chloride-induced corrosion.
- Sikagard®-8500 CI

Film-forming inhibitor:
Corrosion inhibitors following method 11.3 (control of anodic area) need to form a continuous film around the embedded bars to prevent induced corrosion. In structures where the main concern is carbonation (e.g. due to low concrete cover) we typically find higher concrete porosity and surface-applied film-forming corrosion inhibitors can easily penetrate. This provides efficient and cost-effective protection.
- Sika® FerroGard®-903 Plus



CORROSION MANAGEMENT

CATHODIC PROTECTION
Corrosion in reinforced concrete occurs in localized areas called corrosion cells. Each cell consists of an anodic (corroding) area and a surrounding cathodic area. Electrons flow from the anodic to the cathodic area. In chloride-contaminated concrete, in presence of water and oxygen, corrosion begins where chlorides first reach the steel reinforcement and break down the protective passive layer (even if the concrete is not carbonated). Due to the way electricity flows within the corrosion cell, the cathodic area remains passivated, despite contamination, hence no corrosion is happening in those surrounding area.

Cathodic protection works by enforcing the rebar to stay cathodic, while an external anode (usually zinc) is applied. It thereby follows principle 10 of EN 1504-9. There are the following two areas of use:

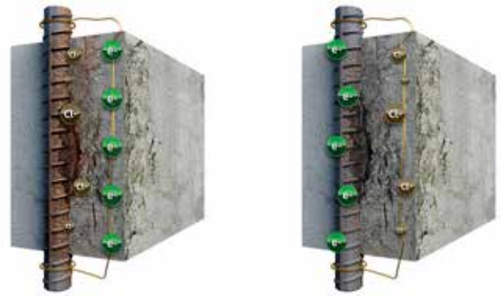
Sacrificial Anode Cathodic Protection / Galvanic Current Protection
When areas of damaged concrete are repaired the new highly alkaline repair mortar changes the polarity of this area. This zone previously anodic is now the newly cathodic zone.

However, by stopping the electron flow, corrosion is triggered at a fast rate in the surrounding, former cathodic zone, that has not been repaired and is already contaminated with water and chloride. This process is called Halo or Incipient Anode Effect also known as incipient anode mitigation.

To prevent this, **Galvanic Anodes** are installed either within the repaired area or preferably in the surrounding concrete to the repair. Due to their zinc content (zinc has a lower electrochemical potential than reinforcement steel), these sacrificial anodes will corrode instead of the steel reinforcement, ensuring that the surrounding steel remains protected and passive.
- Sika® FerroGard®-500's Patch Galvanic Anodes
- Sika® FerroGard®-700's Reba & -600's Galvanic Anodes

Impressed Current Cathodic Protection
Cathodic protection is an effective solution that avoids large concrete removal, the risk of spalling repair areas and enables long-term protection, also when contamination levels – such as high chloride concentrations – are too severe for conventional concrete protection methods to be effective. However, in demanding cases, relying solely on standard sacrificial galvanic anodes may not be sufficient to fully stop the corrosion process. In this case an additional power supply is needed to repassivate the reinforcement steel or move negatively charged chloride ions away from the reinforcment steel. In the "incipient current cathodic protection", the anode is installed in the form of a net, stripes (both usually titanium) or a conductive coating. In all cases the anode requires a constant power supply. Sika offers bedding mortars for these anodes:
- Sika MonoTop®-4012
- Sika MonoTop®-4052.

Discrete anodes can be installed using:
- Sika MonoTop®-815 CP grout.



Hybrid Anode Protection
Hybrid anodes combine the benefits of **Impressed Current Cathodic Protection (ICCP)** and **Galvanic Current Protection**, offering long-term corrosion control without the need for a constant power supply, current adjustments, or the risk of risk of over-alkalinization due to excessive electricity. By using potential field mapping, hydrid anodes offer the opportunity to adjust the cathodic protection area better to the critical zones. This advanced solution can effectively extend the service life of concrete structures in harsh environment for decades by decades, providing a reliable and cost-effective corrosion management strategy. The effectiveness of the hybrid anode protection can also be monitored over time using a reference electrode.

To address this challenge, Sika offers the **Hybrid Anode Technology**, which provides an initial "repassivation boost" by applying a small amount of external energy (battery-powered) for a minimum of one week. This initial current effectively provides concrete realkalisation and chloride extraction around the reinforcing steel. Once enough current has passed through the steel, the external source of current can be removed and the passivity can then be maintained by the galvanic current provided by the sacrificial galvanic anodes for an extended period, (refered to as "passive mode" – explained in the galvanic current protection chapter before). If needed, an additional boost can be applied even decades later.
- Sika® FerroGard®-300's Duo Hybrid Anodes
- Sika® FerroGard®-400's Patch CC Galvanic Anodes

REPAIR MANAGEMENT

When reinforced concrete is impacted by corrosion, extensive repair work becomes necessary. Sika's Repair Management concept offers a complete range of materials for concrete restoration.

- Steel Bar Protection
- Structural Repair Mortars
- Resurfacing Mortars

INJECTION
Concrete is naturally prone to cracking. While some cracks are normal – such as shrinkage cracks – or even necessary for steel reinforcement to take over tensile loads, others can pose a serious threat to structural integrity. Cracks that allow water and contaminants to penetrate must be properly sealed to prevent long-term damage.

Sika offers a comprehensive range of injection solutions to effectively fill cracks and restore concrete durability. Our most commonly used epoxy-based injection products include:
- Sikadur®-52 (High-strength epoxy injection resin)
- Sikadur®-53 (Designed for water-saturated cracks)
- SikaInject®-1360
- SikaInject®-1380



STEEL BARS PROTECTION
When the concrete cover falls below requirements, additional corrosion protection is essential for exposed prepared reinforcing steel. The product must comply to EN 1504-7 standards.
For general protection in carbonated structures or buildings/structures with moderate chloride contamination use:

1 Component Cement Based
- Sika MonoTop®-1010
- SikaEmaco® P 5000 AP

For highly aggressive environments such as marine structures, wastewater treatment plants, cooling towers, etc.:
3 Component Epoxy Cement Based
- SikaTop® Armatec®-110 EpoCem®

STRUCTURAL REPAIR MORTARS
The repair material must be capable of retrofitting the structure and preventing further deterioration. The repair mortar should comply with EN 1504-3 and, depending on the strength requirements of the structure, should meet either class R3 or R4 requirements.

Hand Applied Mortar / Wet Spray Application/Pump-Fix
- Sika MonoTop®-4012
- Sika MonoTop®-4080 (with integrated corrosion inhibitor)
- Sika MonoTop®-4052 (for horizontal repairs)
- SikaEmaco® S 488
- SikaEmaco® S 5800 DUO (class R3)

Hand-applied Mortar / Fast-setting / Extra high strength (> 85 MPa)
- SikaEmaco® S 5440 RS (with integrated corrosion inhibitor)

RESURFACING MORTARS
To achieve a pore-free surface and, in some cases, to increase concrete cover for suitable durability, resurfacing mortar complying with EN 1504-3 and/or EN 1504-2 can be used.

1 Component Resurfacing/Pore Filler Mortar
- Sika MonoTop®-3020
- SikaEmaco® N 5100 FC

3 Component Resurfacing – High Aggressive Environment
- Sikagard®-720 EpoCem®

STRENGTHENING MANAGEMENT

When corrosion significantly impacts internal steel reinforcement, or when fatigue or structural overload compromises structural integrity, implementing strengthening measures becomes essential. Sika's Strengthening Management concept offers comprehensive solutions and advanced calculation tools, tailored to meet all structural strengthening requirements.

- Flexural Strengthening
- Shear Strengthening
- Confinement
- Deflection Reduction
- Active Strengthening



FLEXURAL STRENGTHENING
Sika strengthening systems improve the structural capacity of the element, increasing the positive and negative resistant bending moment. These systems can be applied as EBR (externally bonded reinforcement) or NSM (near surface mounted).
- Sika® CarboDur® carbon fibre laminates
- Sika® CarboDur® carbon fibre rod

SHEAR STRENGTHENING
Sika strengthening systems are engineered to enhance the shear capacity of concrete beams and walls, providing a robust safeguard against fragile collapse mechanisms, including shear failure.
- SikaWrap® carbon fibre fabric (230–1,400 g/m²)
- Sika® CarboShear L-shaped carbon fiber laminates

CONFINEMENT
Sika strengthening systems are effective to improve the axial load and combined axial load and bending capacity of square, rectangular or round concrete columns.
- SikaWrap® carbon fibre fabric (230–1,400 g/m²)
- SikaWrap® glass fibre fabric (430–930 g/m²)

DEFLECTION REDUCTION
Sika solutions for deflection reduction are based on high performing CFRP systems that can be applied on the concrete surface or in slits in the substrate.
- Sika® CarboDur® carbon fibre laminates
- Sika® CarboDur® carbon fibre rod

ACTIVE STRENGTHENING
For special higher strengthening needs, the active strengthening system based on pre-stressed CFRP plates is the most effective.
- Sika® CarboStress® external prestressed system with carbon fibre laminate

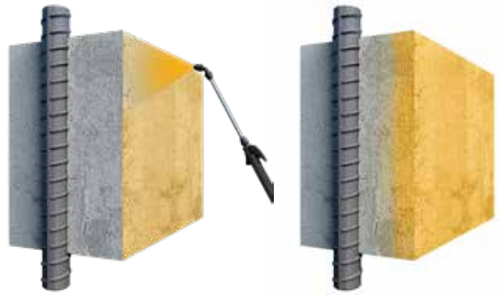
PROTECTION MANAGEMENT

Once the appropriate renovation and corrosion management works have been carried out, protecting the concrete against the penetration of deleterious elements will prolong the design life of the structure. Protection Management from Sika provides all types of concrete protection solutions, from invisible impregnation to crack-bridging coating systems.
These protective solutions not only increase aesthetics, but also offer a sustainable way of maintaining our structures.

- Hydrophobic Impregnation
- Protective Coating



HYDROPHOBIC IMPREGNATION / INVISIBLE PROTECTION
Many modern architects strive to preserve the natural mineral appearance of their structures. Therefore, to enhance or maintain their durability, invisible protection against moisture ingress and soluble deleterious elements is essential.



<u>Silane Based</u>
- Sikagard®-705 L
- Sikagard®-706 Thixo (Creme)
- Sikagard® H 1000/1100
- Sikagard®-740 W

<u>Silane/Siloxane Based</u>
- Sikagard®-704 S
- Sikagard®-730 Concrete Protect Plus (Creme)
- Sikagard® H 303

PROTECTIVE COATING
Sika's range of protective coatings encompasses diverse requirements, spanning from crack-bridging to rigid coatings and from vapour-permeable to vapour-impermeable, suitable for nearly all project types. These coatings are designed to perform reliably in vastly different environmental conditions, ranging from the cold climate of the Northern hemisphere to the hot and dry weather of desert areas as well as tropical conditions.

<u>Acrylic Flexible System</u>
- Sikagard®-5500
- Sikagard®-330 EL

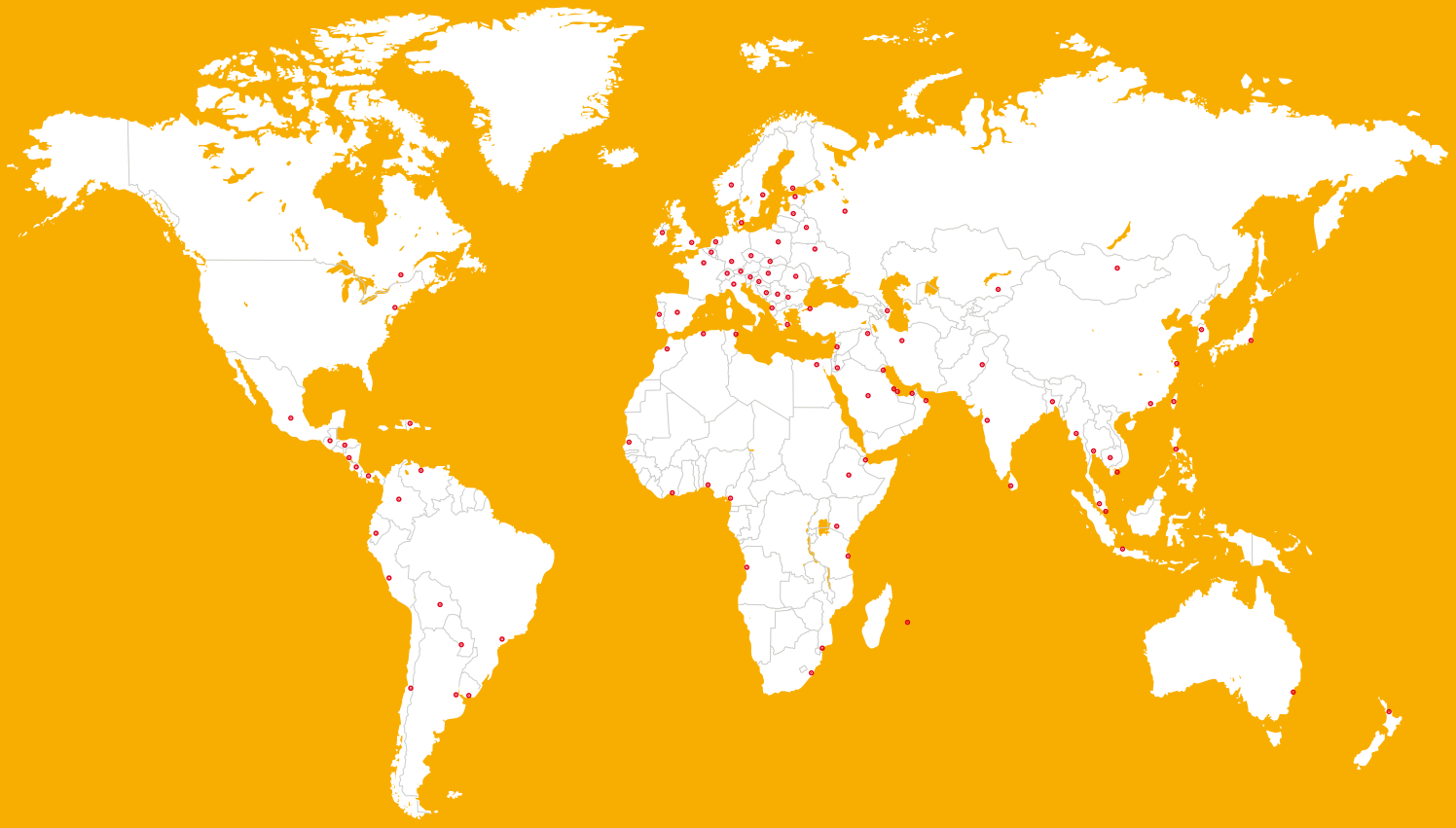
<u>Acrylic "Rigid" System</u>
- Sikagard®-675 W ElastoColor
- Sikagard®-320

<u>Reactive Coating</u>
- Sikagard®-7000 CR
  (for waste water with biogenic sulphuric acid attack)
- Sikagard®-62/63 N (for chemical protection)
- Sikagard®-2406 Protection
  (for Natural Draugh Cooling Tower protection)
- Sikagard®-340 WCT (for tunnel concrete protection)
- Sikagard® M 391 (for solid food stuff contact)



NOTES

GLOBAL BUT LOCAL PARTNERSHIP



WE ARE SIKA

Sika is a specialty chemicals company with a leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing and protecting in the building sector and the motor vehicle industry. Sika's product lines feature concrete admixtures, mortars, sealants and adhesives, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

Our most current General Sales Conditions shall apply. Please consult the most current local Product Data Sheet prior to any use.

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