



## MasterProtect 8000 CI

Longer Service Life of Concrete Structures with Proven Corrosion Inhibiting Technology



# MasterProtect 8000 CI: Class-leading Concrete Protection

Reinforced concrete can be exposed to harsh environmental conditions threatening its structural integrity. The MasterProtect and MasterEmaco product range offers a suite of solutions from major repair and strengthening to preventing and preservation. MasterProtect 8000 CI is the only class-leading and proven solution for corrosion inhibition.

## Concrete is exposed to various attacks

Corrosion, chloride attacks or carbonation are demanding challenges for concrete structures and buildings. Concrete protection is needed to safely preserve the visual appearance and to guarantee the longevity of concrete structures.

## Concrete damage

Mechanically      Chemically      Physically

## Reinforcement corrosion

Carbonation      Chloride attacks      Stray currents

### Product benefits at a glance:



#### Excellent application properties

Applied by spraying, rolling or brushing



#### Durability

10+ years of proven results by on-site monitoring



#### Corrosion protection

Effective inhibition of both carbonation and chloride induced corrosion



#### Certification, documentation and test reports

Certified in accordance with European standards



#### Time-efficient installation

One-off installation cost



#### Significantly reduces water ingress

Ability to improve the energy rating of buildings (acc. to LEED ratings)



# MasterProtect 8000 CI – Product Features

## Single-component, silane-based corrosion inhibitor

MasterProtect 8000 CI surface-applied corrosion inhibitor (SACI) combines key attributes from multiple class-leading concrete protection products. It migrates through the porosity

of the concrete to the rebar, where it generates a highly corrosion-resistant environment stopping the corrosion process and therefore preventing further damage.

### Features

- Does not form a layer on the surface and penetrates deep into the concrete
- Prevents anodic and cathodic corrosion reactions
- Strengthens the passive layer on the steel reinforcement
- Significantly reduces water ingress

### Advantages

- Freedom to apply protective coating for e.g. aesthetic reasons
- Surface appearance remains unchanged
- Delays the initiation of corrosion and reduces active corrosion significantly

### Benefits

- Extends the service life of structure
- Reduces maintenance costs and cost of operational downtime
- One-off installation cost only

### Fully certified and proven technology



MasterProtect 8000 CI has been independently tested and certified by several European research councils.



MasterProtect 8000 CI is certified in accordance with European standards.



Quick Evaluation Guide useful for initial assessment of potential corrosion.





# Concrete Protection: Avoiding Future Costs

Over the past 15 years, there has been an unprecedented increase in the use of concrete in infrastructure and industrial facilities, as well as commercial and residential buildings. But how long do concrete structures last?

### Extending service life of concrete structures

A growing demand for longer service lives and the need to rehabilitate and renovate existing buildings have led to a need for preventive and repair techniques that match these durability expectations. Increasingly severe climatic, environmental and service conditions are posing new challenges for structures designed for longer service lives.

### MasterProtect 8000 CI – Expressed in figures

**40 %** cost reduction

At our Torres Blancas reference-project in Alicante construction time was shortened by several weeks and renovation costs remained 40 % below those estimated for a complete replacement.



**10 +** years

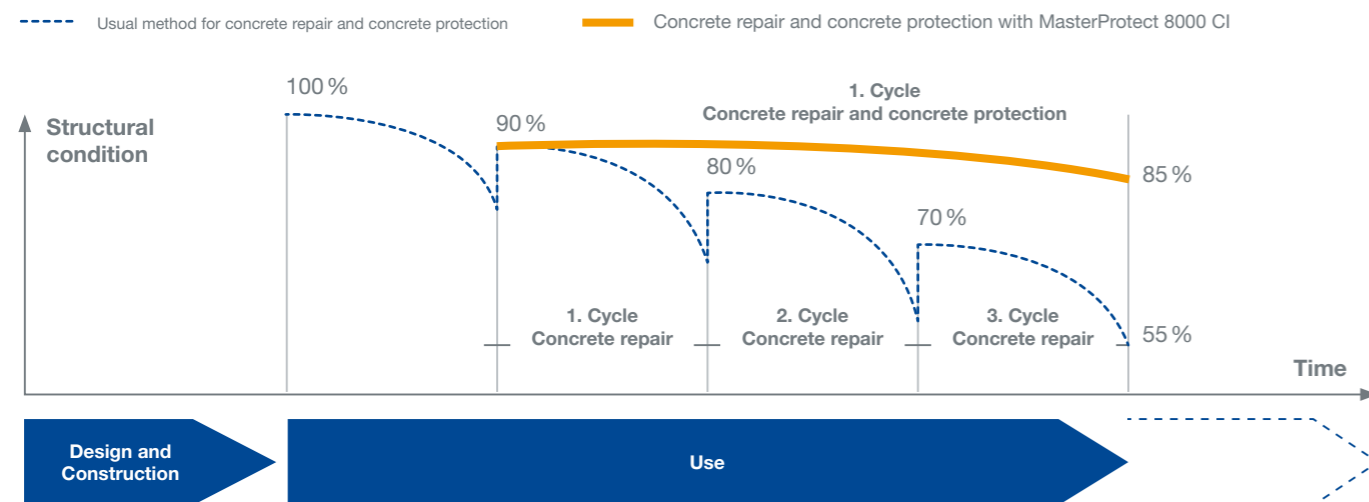
More than a decade of construction knowledge and experience. Our local experts help you to find the most efficient solution for concrete protection.



**1** component

MasterProtect 8000 CI is a single component corrosion inhibitor – it's ready to use and no extra material is needed.

### Extending service life of concrete structures with the right solutions

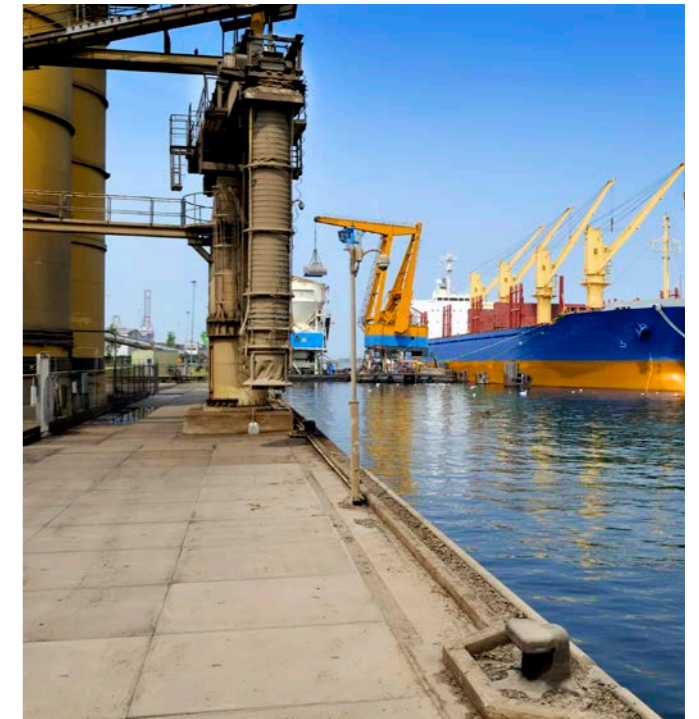


Example of interaction of protection materials and repair mortar (depends on project condition and is therefore different for each project). © BASF

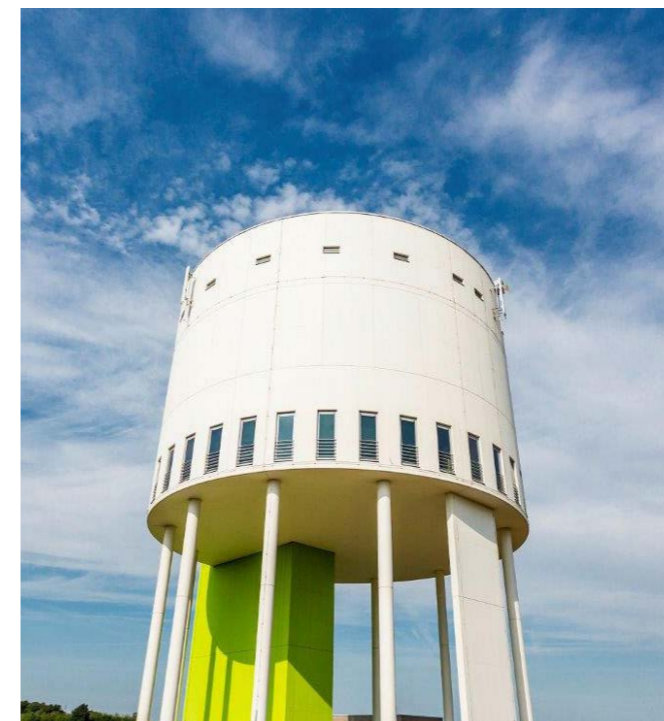
### Typical structures with severe risk potential



Buildings located in coastal areas



Typical marine structures such as quays, jetties, bridges in direct splash zones



Industrial tanks, silos or pools in contact with chlorinated water or exposed to airborne salts



Areas exposed to heavy use of any de-icing agents (salts), e.g. parking decks





## Explaining MasterProtect 8000 CI in More Detail

### How to detect corrosion at an early stage

Corrosion in reinforced concrete is typically a slow chemical process that involves naturally occurring CO<sub>2</sub> or chlorides. Before corrosion results in visible damage to the concrete structure, there is an invisible process which can take from a few months to several years and even lead to severe structural failure. Structures in extreme environments or at risk should be examined even if there are no visible signs in order to avoid the need for costly repairs.

### Rapid measurements by in-situ tests

The corrosion rate in a real concrete structure can be rapidly measured by in-situ tests using non-destructive handheld devices which induce galvanostatic pulses in the concrete area and estimate the corrosion rate using numerical algorithms (expressed in  $\mu\text{A}/\text{cm}^2$ ).

### The degree of corrosion determines what actions need to be taken

Corrosion rate ( $\mu\text{A}/\text{cm}^2$ )	Corrosion level of the structure	Estimated time until visible damage
< 0.1	Negligible (passivated)	–
from 0.1 to 0.5	Low	> 10 years
from 0.5 to 1.0	Moderate	3 – 5 years
>1.0	High	< 2 years

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### Typical causes of damage and appropriate solutions

There are two main corrosion processes: carbonation and chloride-induced corrosion. Carbonation is a process by which the natural pH of the concrete is reduced, eventually destroying the passive layer that protects the steel and allowing the steel to corrode. In chloride-induced corrosion, chloride penetrates the concrete. Once it reaches the steel, the passive layer is disturbed and corrosion pitting occurs.

### Two ways of protection

Signs that corrosion is already becoming a problem include rust staining, cracks and minor delaminations. MasterProtect 8000 CI provides protection in two ways. Firstly, it inhibits corrosion by repairing the passive layer on the steel. Secondly, it reduces the ingress of water by creating a layer in the concrete matrix.

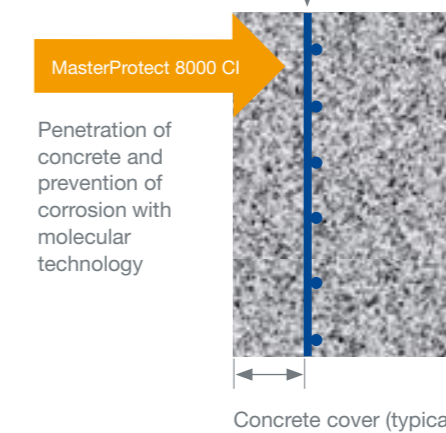
### Unique combination

This unique combination makes this product ideal for service life extension after the repair of spalled concrete and as a protective mechanism where surveys show that the structure is subjected to a potential corrosion risk as a result of environmental conditions.

### Factors that increase corrosion potential:

- Sea water (salt)
- Carbonation (loss of passivation layer)
- De-icing agents (salts)
- Insufficient concrete cover
- Cracks and delamination
- Mechanical damage

Steel reinforcement subject to potential corrosion reaction

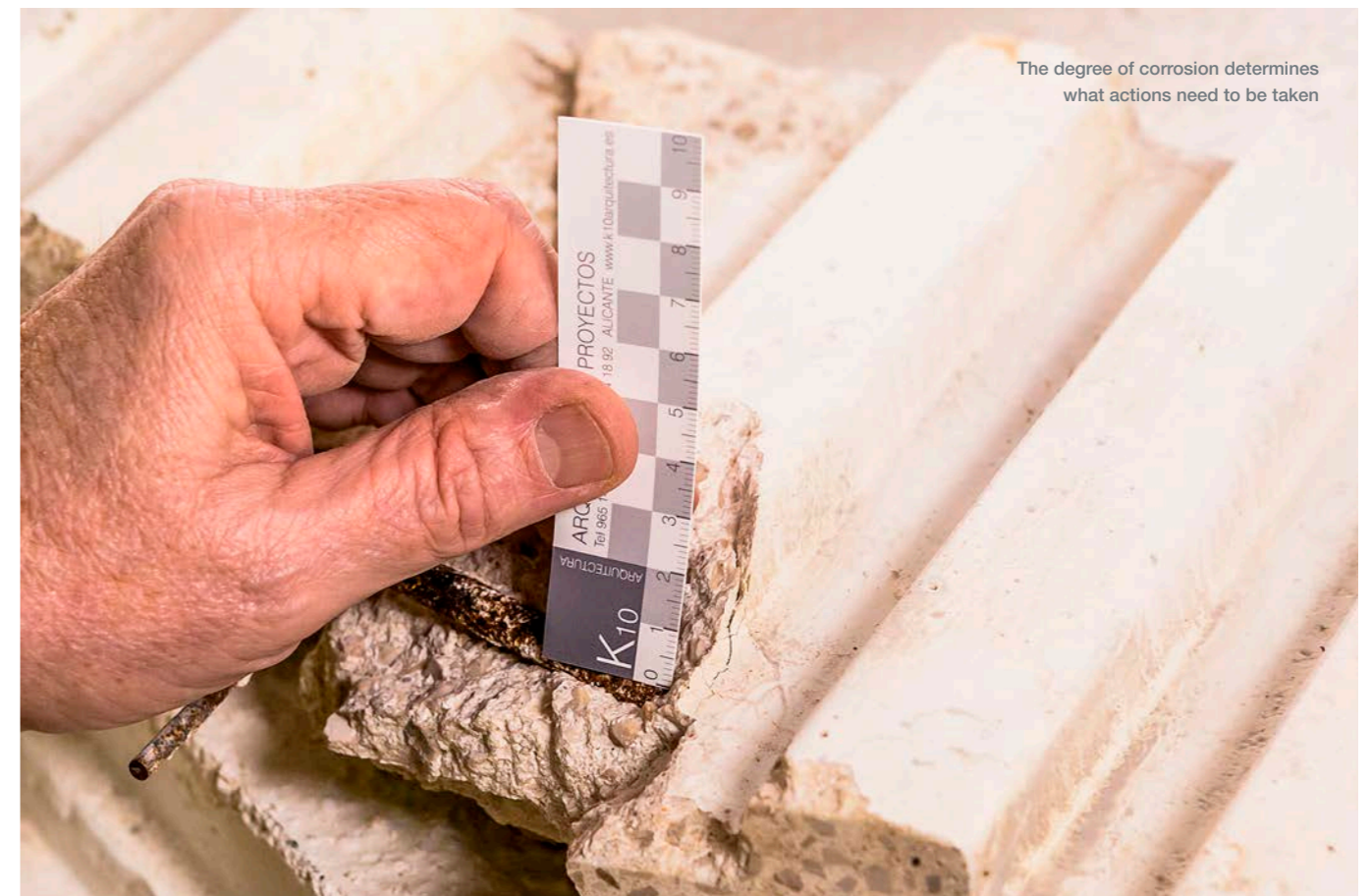


### The effective solutions:

- MasterProtect 8000 CI** – the liquid surface applied corrosion inhibitor for large areas

Often in combination with

- MasterEmaco** series repair mortars for structural and nonstructural damage repair
- MasterProtect 330 EL** for further anti-carbonation protection, aesthetics





# MasterProtect 8000 CI – Saving Costs in the Long Run

## Ensuring the profitability with our LCCA

For owners and engineers alike, calculating the benefits of a repair and protection method over a given life cycle is crucial to selecting the most cost effective solution.

## We can prove the cost-effectiveness

BASF has drawn upon expert knowledge from the industry to develop a life cycle cost analysis (LCCA) tool to assist our customers with this task.

The output of an analysis can be readily made available to the project team in the form of a report.



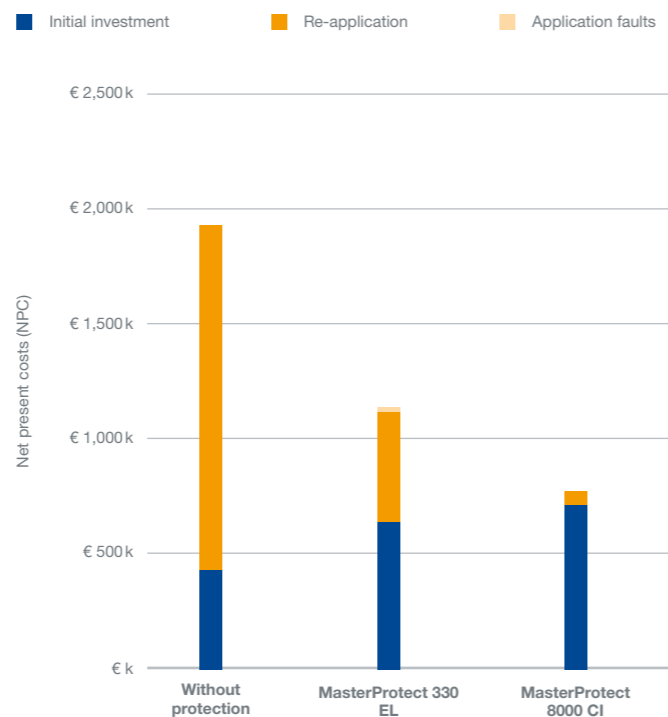
### LCCA report typically includes:

- A life cycle cost comparison
- Annual cost analysis
- Cumulative net present cost (NPC) analysis
- Initial recommendation for most cost-effective solution

## Life cycle cost comparison – a case study

A direct comparison of the proposed protection methods compared with a standard repair and maintenance approach: The case study results presented in the graphs below are based on a silo refurbishment project where crack repair using MasterInject and structural repair with MasterEmaco mortars have been simulated. As a base case only the initial repair and recurring repair works have been modelled whereas with the MasterProtect 330 EL anti-carbonation coating and most favorable MasterProtect 8000 CI corrosion inhibitor, repair works will no longer be required in the future. MasterProtect 8000 CI – primarily due to its cost effectiveness – is the most preferable treatment in this case study.

## MasterProtect 8000 CI: Lowest overall cost

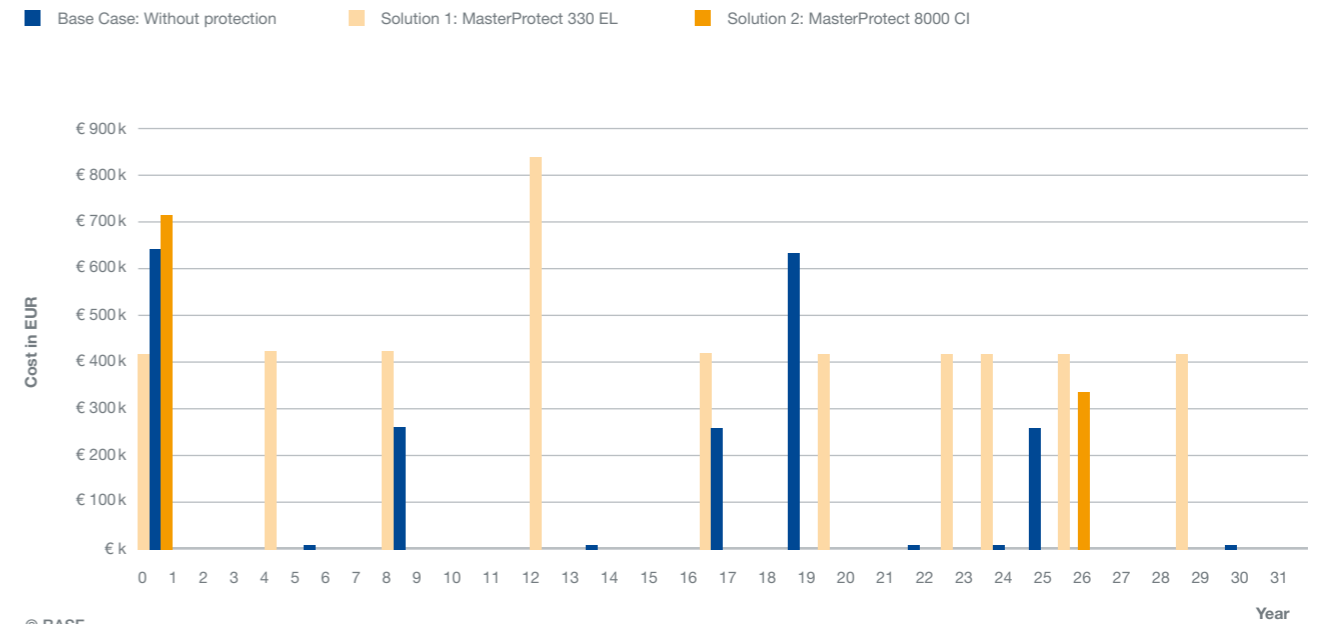


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## MasterProtect 8000 CI only needs to be applied initially and after 26 years

### Yearly costs

Overview of the yearly expenditures associated with each option – adjustable to specific needs

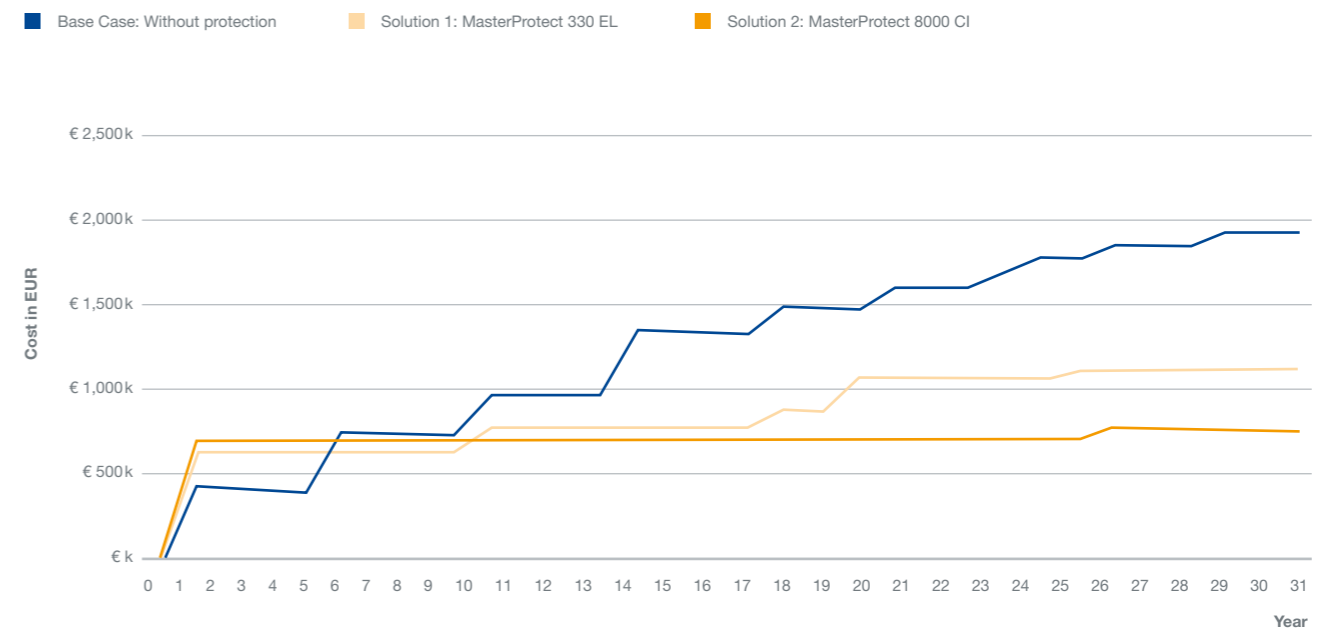


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## MasterProtect 8000 CI: High initial application costs, but most profitable solution in the long run

### Cumulative costs (NPC)

Discounted net present costs to demonstrate the most cost effective solution as shown in the final life cycle cost report



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# Choosing the Right Solution for Your Challenge

In order to ensure durable concrete in the field, it may not be sufficient to meet the minimum requirements of EN 206. In addition to the design of the concrete the proper placement, including the required concrete cover, are key factors for achieving a durable structure.

### Selecting the right solution

From design to curing – whenever a small deviation from the specified design and application occurs, it opens the way for concrete degradation and deterioration. Then it is only a question of time before accelerated carbonation, chemical attack and de-icing salts will start to damage the concrete

and the structure as a whole. In order to avoid this kind of concrete degradation, protection materials are used for new and refurbished structures.

### Safe and reliable solutions

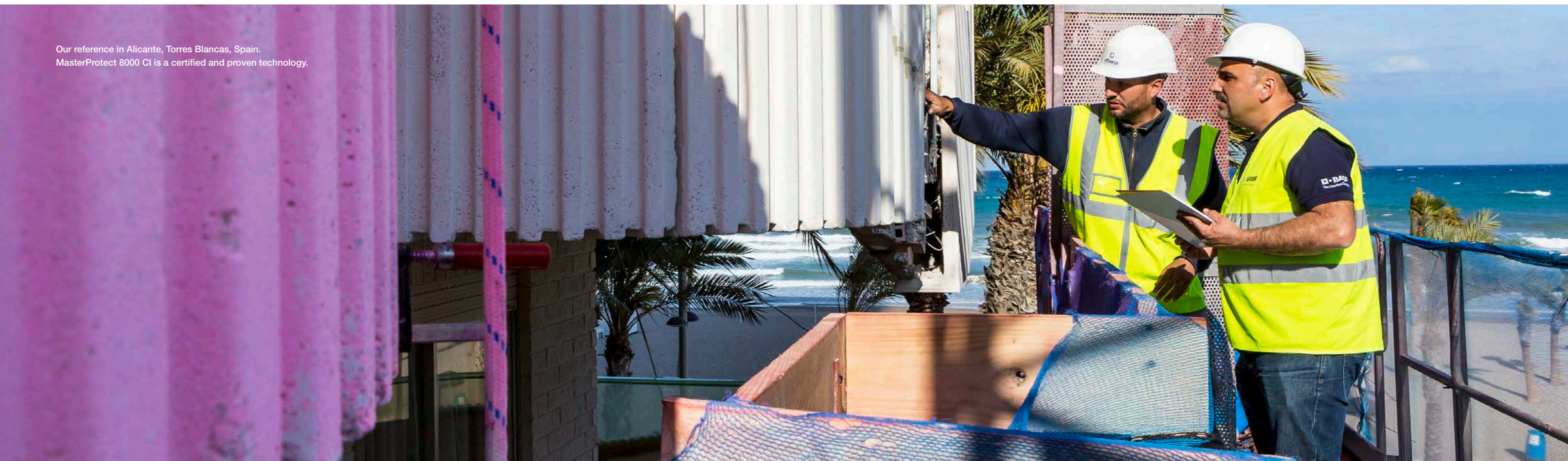
#### Exposure classes

The recommended surface-applied protection solution can be classified to coincide with the major concrete exposure classes defined in EN 206-1 “Exposure Classes”.

### MasterProtect Product Selector

	Decorative Paint	Acrylic Coatings	Corrosion Inhibitors	Hydrophobic Treatment	Resin Based Coatings
Environment	No risk of corrosion or attack	Carbonation-induced corrosion	Chloride-induced corrosion	Freeze/thaw attack	Aggressive chemical environment
Exposure class code	X0	XC1–XC4	XS1–XS3 XD1–XD3	XF1–XF4	XA1–XA3
Solution		<b>MasterProtect 330 EL</b>	<b>MasterProtect 8000 CI</b>	<b>MasterProtect H303</b>	<b>E.g MasterSeal</b>

Our reference in Alicante, Torres Blancas, Spain.  
MasterProtect 8000 CI is a certified and proven technology.







## Access to Expertise and Knowledge from Around the World

Our Master Builders Solutions experts are committed to giving you the right information and most cost-effective solution for your concrete protection or restoration challenge.

### Enhance your structure's value

By providing an early and preliminary diagnosis and assessment of the current situation and recommending the right solutions to protect against the ingress of carbon dioxide, water and chloride ions from the start, we can significantly enhance your structure's value and service life, and avoid further deterioration and spalling.



### Corrosion rate measurements by Master Builders Solutions technical experts

- Early detection of corrosion potential is key to effective protection and repair solutions.
- Please contact your local sales consultant to assist with an early assesment of your project.



Master Builders Solutions expert in dialog with customer at the project site



Hang Zhou Bay Bridge, People's Republic of China



Albert Bridge, Windsor, UK



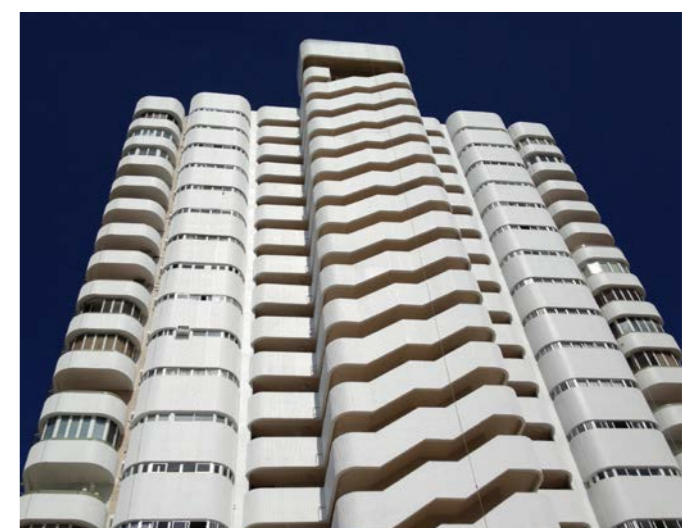
Christiansborg Slotstårn, Copenhagen, Denmark



Yilport Jetty, Kocaeli, Turkey



Tachibana Bridge, Japan



Torres Blancas complex, Alicante, Spain





## Fundació Miró Museum in Barcelona, Spain

### The challenge

The Miró Foundation Museum in Barcelona is made of reinforced concrete and was built in 1975 on the slopes of Montjuïc, the hill overlooking the city. Its facade consists mostly of exposed reinforced concrete precast panels, coated with paint to simulate the appearance of white concrete.

Given its age, the quality of concrete used at that time, and especially its proximity to the sea, the building suffered from a serious corrosion problem that was clearly visible in some areas. The outer walls were the worst affected. In some areas, highly corroded reinforcement had already broken through the concrete cover.

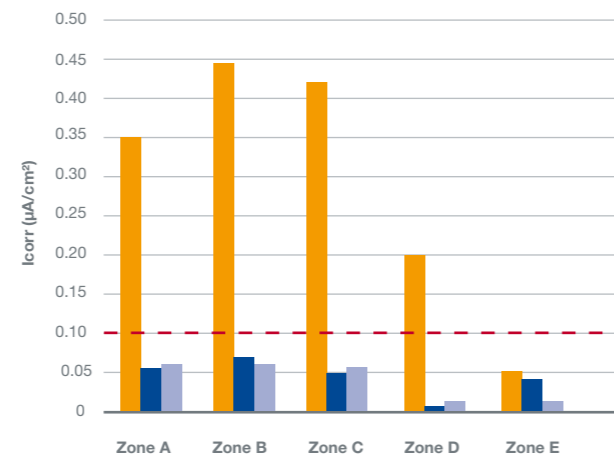
### The solution

An early action plan was drawn up to stabilize the structure, with implementation scheduled for 2005. While the original plan for repairs to the exterior walls of the building involved comprehensive patch repair and cathodic protection throughout the structure, the final revised plan primarily involved a diagnosis and condition assessment of the structure with only minor overall concrete repair.

The assessment and results were then used to define the repair treatments to be applied in each specific area, based on the degree to which they had been affected. BASF has conducted extensive monitoring of the effectiveness of its surface-applied corrosion inhibitor (SACI) MasterProtect 8000 CI.

The product was applied in 2005 and monitoring was carried out in 2007, 2013 and 2015, obtaining spectacular results even under adverse seaside climate and concrete carbonation related conditions.

### Performance of MasterProtect 8000 CI



■ Initial measurements before treatment  
 ■ 7.5 years after application  
 ■ 10 years after application  
 - - Corrosion Threshold (above this value structure suffers from active corrosion)

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# 50 %

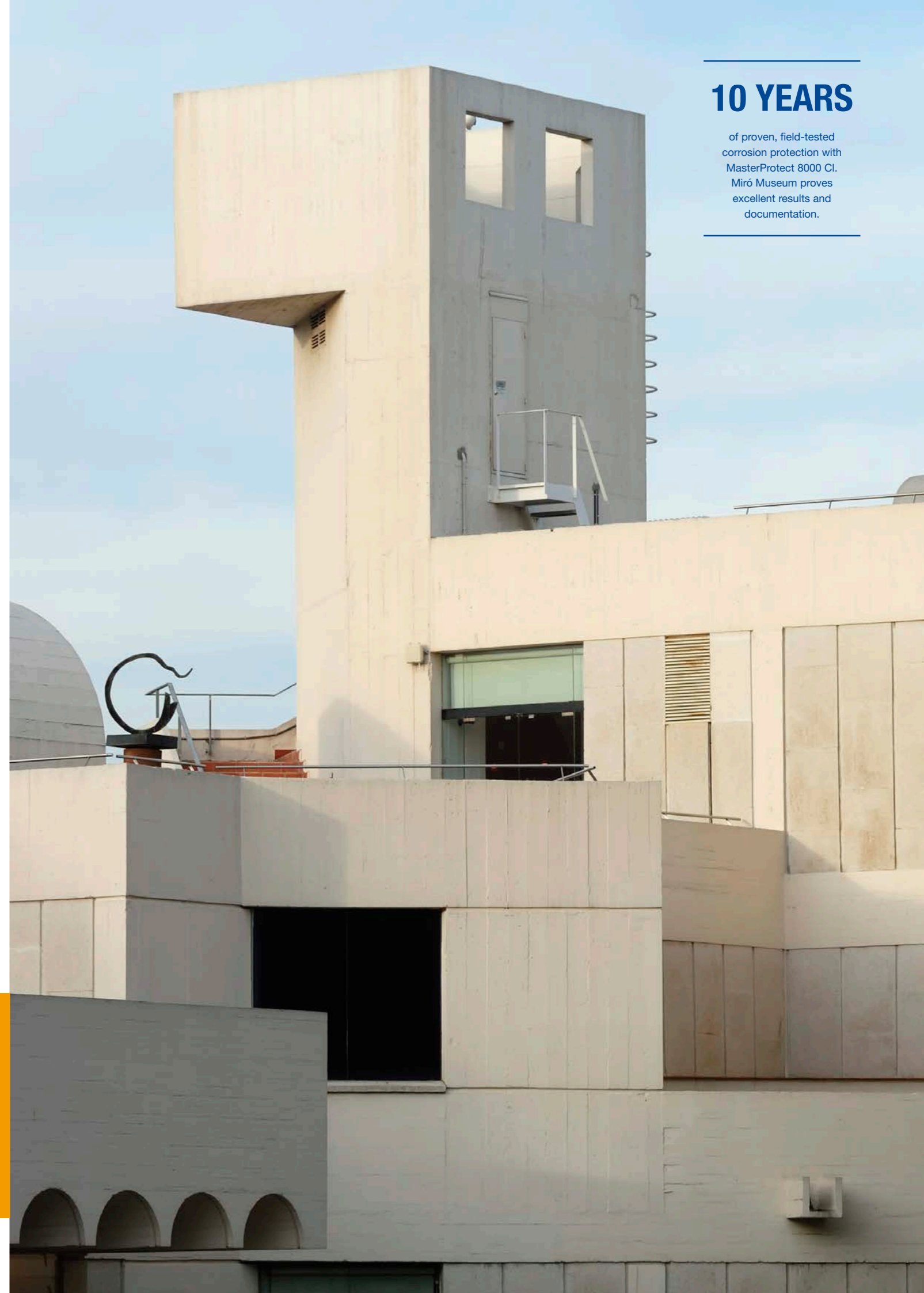
COST REDUCTION

### The overall results were:

- Cost reduction over 50 % compared to complete repair works
- Measureable effectiveness of SACI solution
- Proof of concept in the field under carbonation and chloride induced corrosive conditions

## 10 YEARS

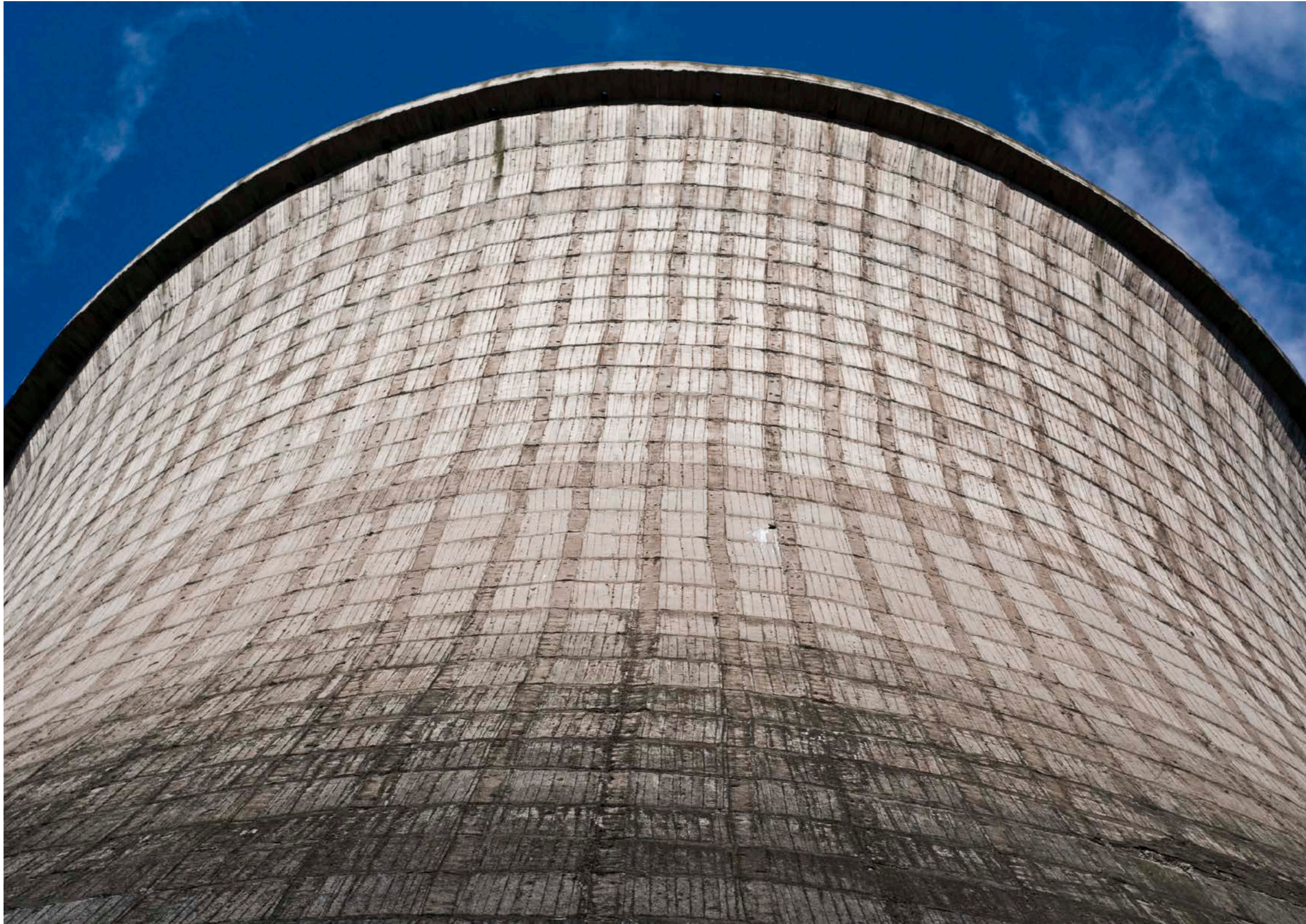
of proven, field-tested corrosion protection with MasterProtect 8000 CI. Miró Museum proves excellent results and documentation.







## Historic Cooling Towers in Beringen, Belgium



### The challenge

Built between 1923 and 1952, the existing four cooling towers in Beringen, Belgium have been part of a national monument of historical significance since 1993. For this reason, traditional protection systems including coatings, which would have changed the appearance of the towers, were not permitted.

A first assessment of the state of the structure concluded that the concrete cover over the steel reinforcement was insufficient to provide a long-lasting resistance to carbonation. In fact, carbonation had already been measured beyond the reinforcement concrete cover and the risk of corrosion-related structural damage was considered to be high.

### The solution

The Master Builders Solutions expert team worked out a plan together with the owners team to meet all the project requirements:

- Long-term protection against further corrosion
- External appearance to remain unchanged
- Extending the life cycle of the cooling towers
- Quick and easy application
- Cost-effective implementation





## Master Builders Solutions from BASF



**Building on partnership.** Our Master Builders Solutions experts find innovative and sustainable solutions to meet your specific construction needs. Our global experience and network help you to be successful – today and tomorrow.

### **BASF's expertise for the construction industry**

The Master Builders Solutions brand brings all of BASF's expertise together to create chemical solutions for new construction, maintenance, repair and renovation of structures. Our competence is built on the experience gained from more than a century in the construction industry, worldwide.

We combine the right elements from our portfolio to solve your specific construction challenges, connecting areas of expertise and regional know-how.



**Please do not hesitate to contact us for more specific information!**



### **Our product portfolio at a glance:**

- Encompasses concrete admixtures
- Cement additives
- Chemical solutions for underground construction
- Waterproofing solutions
- Sealants
- Concrete repair and protection solutions
- Performance grouts
- Performance flooring solutions





# Master Builders Solutions from BASF for the Construction Industry

## **MasterAir**

Complete solutions for air entrained concrete

## **MasterBrace**

Solutions for concrete strengthening

## **MasterCast**

Solutions for the manufactured concrete product industry

## **MasterCem**

Solutions for cement manufacture

## **MasterEase**

Low viscosity for high performance concrete

## **MasterEmaco**

Solutions for concrete repair

## **MasterFinish**

Solutions for formwork treatment and surface improvement

## **MasterFlow**

Solutions for precision grouting

## **MasterFiber**

Comprehensive solutions for fiber reinforced concrete

## **MasterGlenium**

Solutions for high performance concrete

## **MasterInject**

Solutions for concrete injection

## **MasterKure**

Solutions for concrete curing

## **MasterLife**

Solutions for enhanced durability

## **MasterMatrix**

Advanced rheology control for concrete

## **MasterPel**

Solutions for water tight concrete

## **MasterPolyheed**

Solutions for mid-range concrete

## **MasterPozzolith**

Solutions for water-reduced concrete

## **MasterProtect**

Solutions for concrete protection

## **MasterRheobuild**

Solutions for high strength concrete

## **MasterRoc**

Solutions for underground construction

## **MasterSeal**

Solutions for waterproofing and sealing

## **MasterSet**

Solutions for set control

## **MasterSure**

Solutions for extraordinary workability retention

## **MasterTop**

Solutions for industrial and commercial floors

## **Master X-Seed**

Advanced accelerator solutions for concrete

## **Ucrete**

Flooring solutions for harsh environments

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