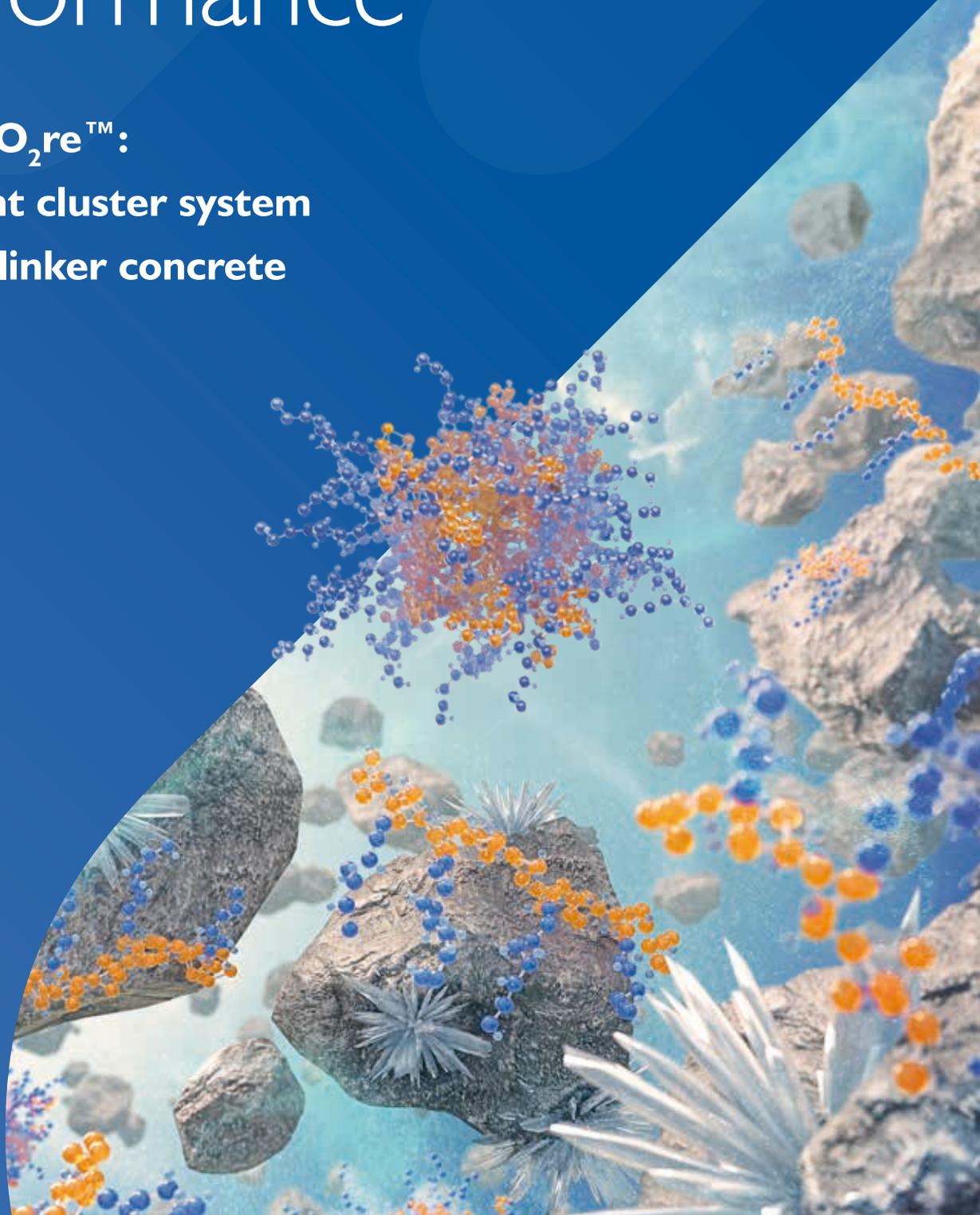


# Sustainable Concrete Performance

**MasterCO<sub>2</sub>re<sup>™</sup>:**  
**Intelligent cluster system**  
**for low-clinker concrete**



# Core Challenge

Global concrete production accounts for 8% of man-made CO<sub>2</sub> emissions worldwide. The ambitious CO<sub>2</sub> reduction targets expressed in the European Green Deal of being climate-neutral by 2050 can only be achieved if the construction sector makes a significant step towards sustainable construction. Reducing the embodied carbon in concrete is, therefore, integral to climate neutrality – with admixtures playing a pivotal role in contributing to the achievement of CO<sub>2</sub> reduction.





## What's the European Green Deal?

Climate change and environmental degradation are severe and existential threats to the world. With the Green Deal, the EU is pursuing the goal of being the first continent in the world to be climate neutral by 2050. The derived sub-targets of the Green Deal are further in line with the EU's commitment to global climate protection measures under the Paris Agreement.



**55%** less CO<sub>2</sub> compared to 1990 levels by 2030



**Net-zero** greenhouse gas emissions by 2050

# Our Core Mission: Simplifying Complexity

**“The core of growth is simplicity.”**

Concrete is the most used building material in the world and it is difficult to envision buildings without it. From a material point of view, its superior properties cannot be replaced by other construction materials as it combines:



Cost efficient and highly flexible use



Durable



High compressive strength



Non-flammable



Pressure and moisture resistance



Fully circular

## Core Ingredients of Concrete

With global consumption of 13.5 billion m<sup>3</sup>, concrete is by far the most widely used man-made material. It combines durability, strength, and design capability with impressive global availability. In its simplest form, concrete consists of cement, water, sand, and gravel. Cement is the binder that connects concrete's primary constituents and provides it with its remarkable properties. Modern concrete formulations also incorporate chemical admixtures which impart distinctive properties to the material in both its fresh and hardened states.

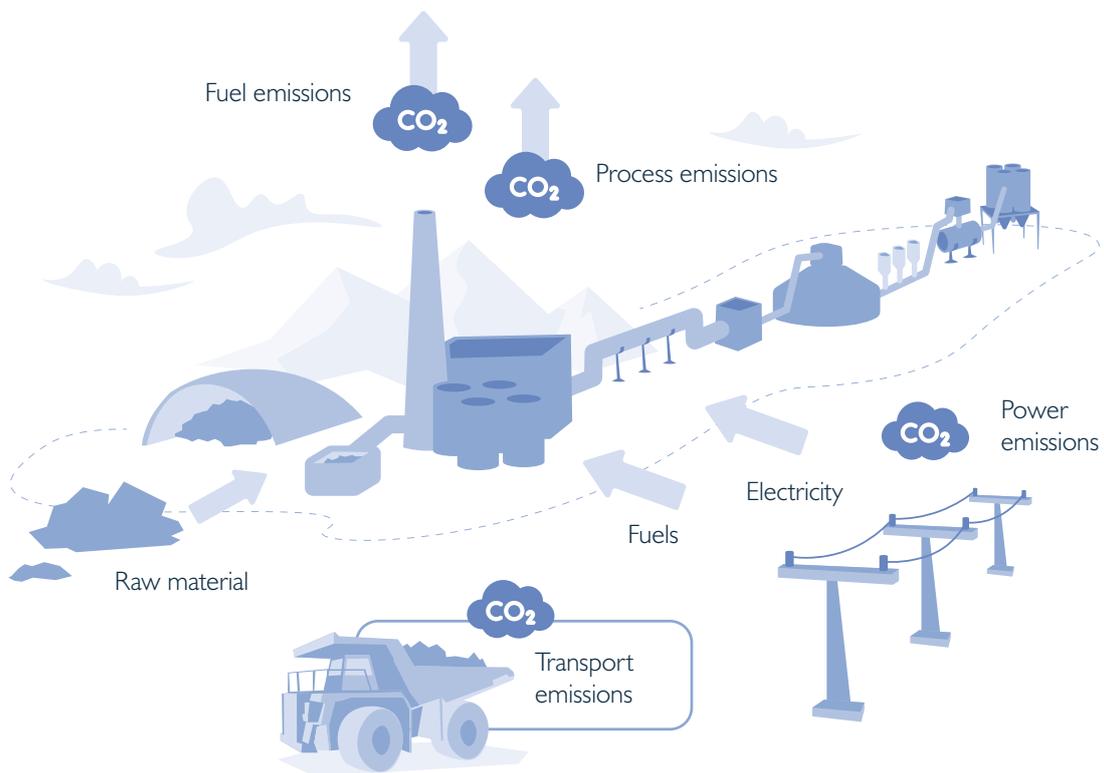
Clinker, the main component of cement, is produced by burning natural raw materials such as limestone, clay, and marl at very high temperatures. This process is responsible for most of the CO<sub>2</sub> emissions of cement. Although clinker generally accounts for only about 10% of the volume of concrete, it is responsible for up to 90% of the CO<sub>2</sub> embodied in concrete.



Lowering the percentage of clinker in concrete is, therefore, a crucial goal to make construction more sustainable in the future. This can be achieved mainly in three ways:

First, by using already clinker-reduced cement types; second, by further reducing the content of conventional cement; and third by replacing a significant portion of cement with supplementary cementitious materials (SCMs).

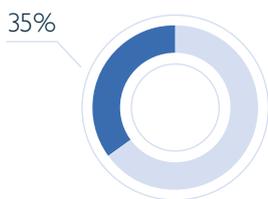
## Cement clinker production process



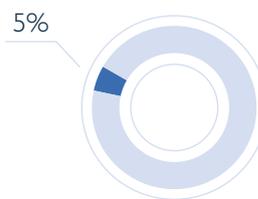
While low-clinker concrete holds the greatest potential for CO<sub>2</sub> reduction in concrete, it also poses major challenges for concrete producers. Limestone filler and SCMs are promising cement substitutes but differ in surface area and quality variations, leading to strong effects on concrete performance. Loss in workability, worsening of rheology, and reduction of strength are the main undesirable outcomes that frequently occur.

MasterCO<sub>2</sub>re™ is our product range for ready-mix and precast applications that addresses the performance gaps and limitations associated with challenging starting materials that conventional superplasticizers cannot overcome – simplifying your challenges and supporting your sustainable journey.

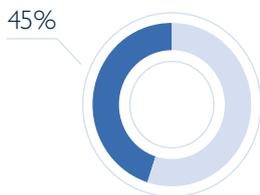
## CO<sub>2</sub> emission drivers in cement clinker production



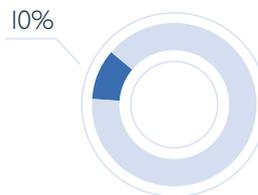
Fuel emissions



Power emissions  
incl. grinding



Process emissions  
 $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$



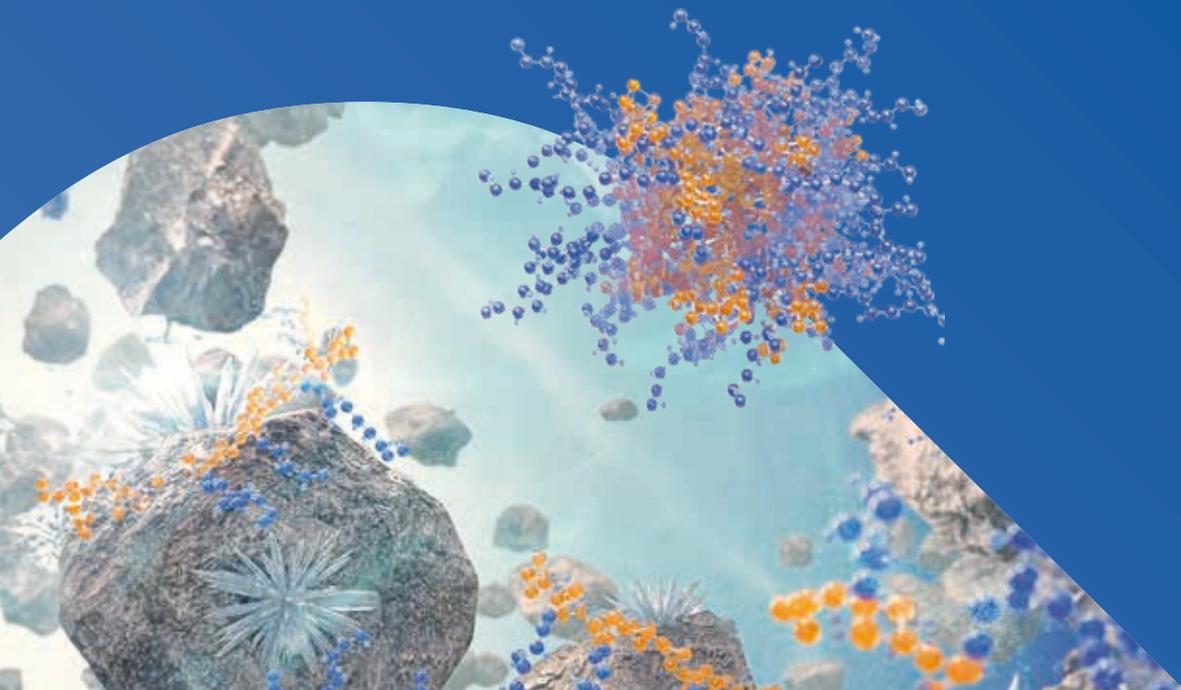
Transport & purchases  
related emissions

# Unveil the Power of MasterCO<sub>2</sub>re™

Transforming construction requires rethinking familiar processes and deploying advanced solutions that pave the way to stay ahead of the industry. MasterCO<sub>2</sub>re™ is a smart technology based on an intelligent cluster system (ICS) that delivers its effects precisely when required. A portion of its freely available polymers is immediately dispersed for initial water reduction. The finely tuned chemical structures of the diverse polymer clusters optimize both workability retention and cement hydration by adapting the release mechanism of polymers to the characteristics of the cement matrix. The unique mechanism of action of MasterCO<sub>2</sub>re™ thus ensures excellent flowability and rheology even at high temperatures, allowing easy pumping and placing of concrete.

MasterCO<sub>2</sub>re™ successfully counteracts the potential of high-water absorption and undesirable interactions with admixtures caused by the variation in chemical and mineralogical composition of binders. Finally, MasterCO<sub>2</sub>re™ allows you to significantly reduce the clinker content in your concrete mix while maintaining the water-to-cement ratio to achieve the required compressive strengths.

Master Builders Solutions® game-changing solution pushes the limits of low-clinker concrete by enabling the easy usage of high volumes of clinker substitutes while safeguarding high concrete quality.



## MasterCO<sub>2</sub>re™ at a glance:



Superb workability retention



Excellent strength properties



Advanced rheology



Unmatched robustness

## MasterCO<sub>2</sub>re™ overall concrete performance



# Our Core Strength: Combining Performance and Sustainable Benefits

MasterCO<sub>2</sub>re™ application case I:

**CO<sub>2</sub> reduction combined with cost optimization in ready-mix**

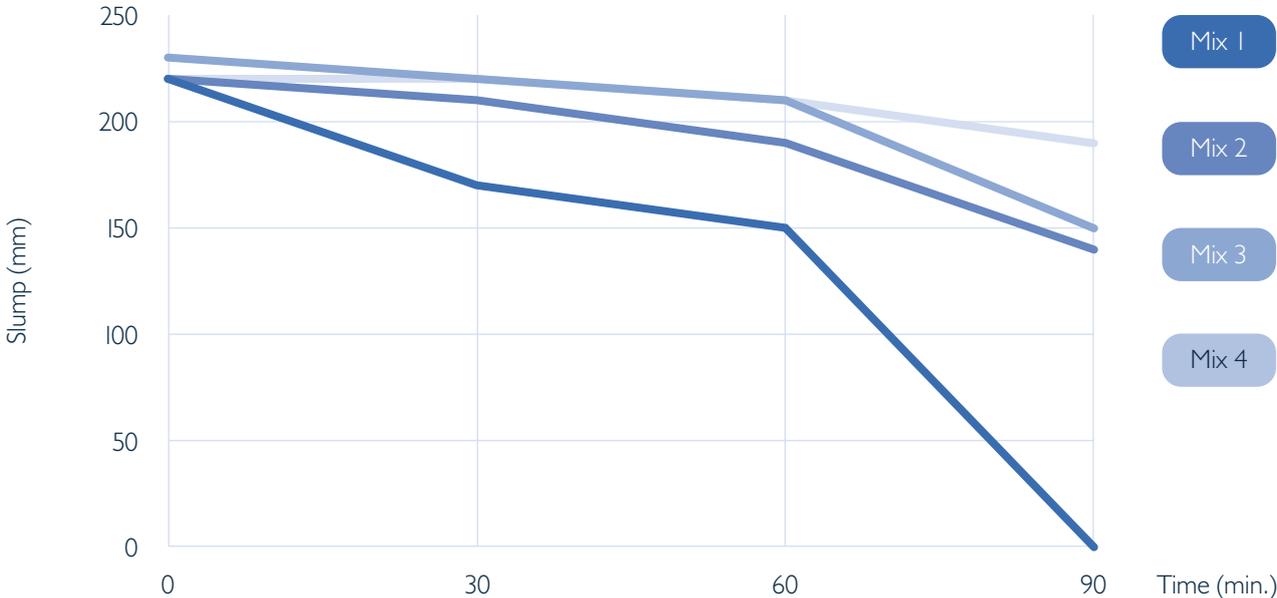
Raw Materials	Mix 1	Mix 2	Mix 3	Mix 4
Natural sand	1,121.00	1,021.00	1,050.00	1,159.00
Round gravel	795.00	824.00	866.00	824.00
Water	170.00	178.00	162.00	150.00
MasterCO <sub>2</sub> re™	0.00	0.00	2.20	3.10
Conventional superplasticizer	2.50	2.20	0.00	0.00
CEM II/A-LL 42.5	307.00	0.00	0.00	0.00
CEM II/B-LL 32.5	0.00	363.00	330.00	307.00
Cost related to cement*/m <sup>3</sup>	42.98 €	47.19 €	42.90 €	39.91 €

\* Assumed average market price:

CEM II/A-LL 42.5: 140 €

CEM II/B-LL 32.5: 130 €

# Workability retention

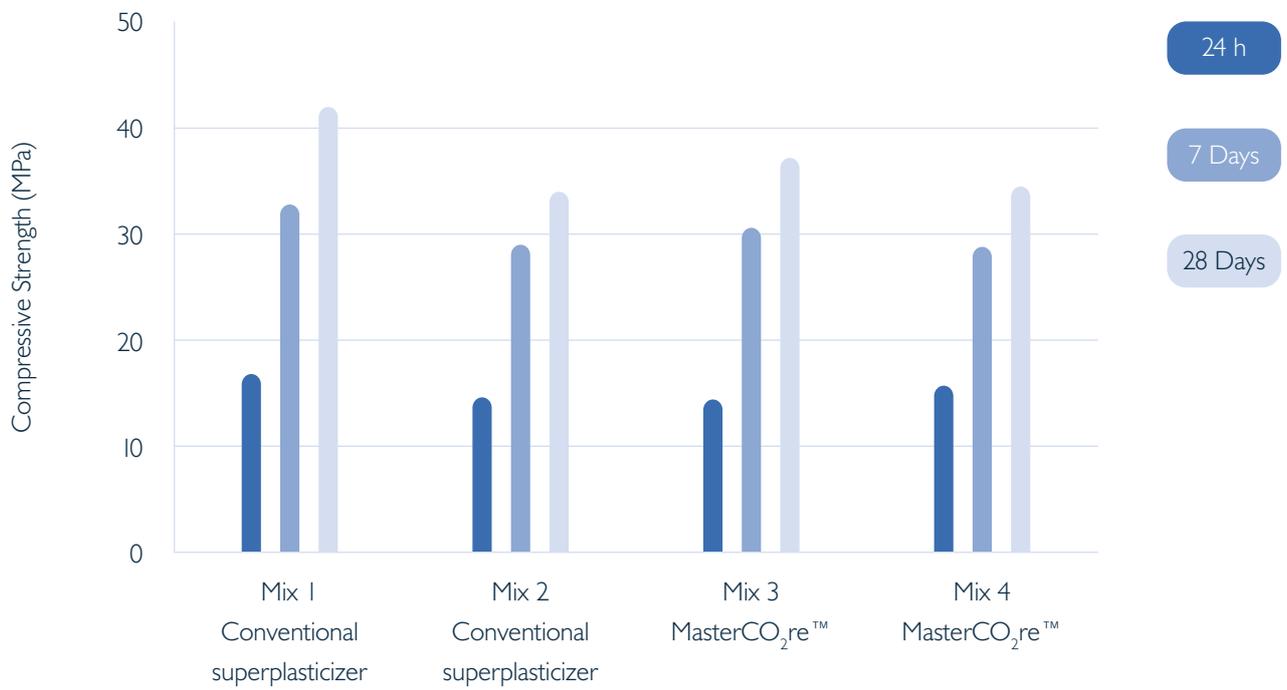




	Mix 1	Mix 2	Mix 3	Mix 4
 kg CO <sub>2</sub> e/m <sup>3</sup>	259 (0%)	262.7 (1.43%)	238.5 (-7.91%)	223.6 (-13.65%)
 Water saved* for daily consumption of	0 people (0%)	2 people (4.71%)	2 people (-4.71%)	6 people (-11.76%)

\* Assumption per person = 3.5 l/day

# Compressive strengths





Reference concrete mix  
(conventional superplasticizer):

**CEM II/A-LL 42.5,  
307 kg/m<sup>3</sup>**

Reference concrete mix  
(conventional superplasticizer):

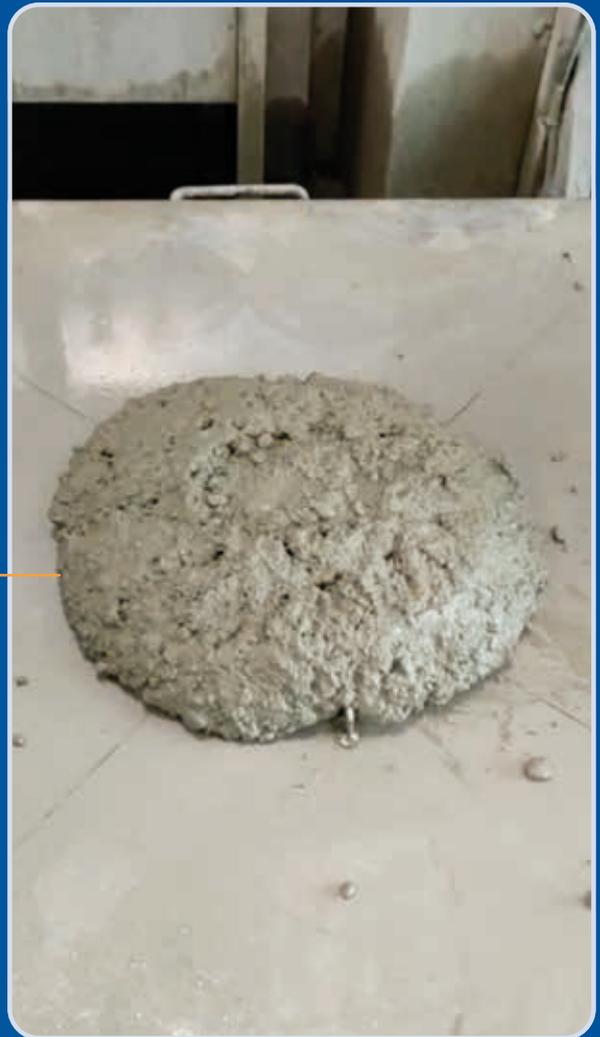
**CEM II/B-LL 32.5,  
363 kg/m<sup>3</sup>**





Concrete mix with  
MasterCO<sub>2</sub>re™ :

**CEM II/B-LL 32.5,  
330 kg/m<sup>3</sup>**



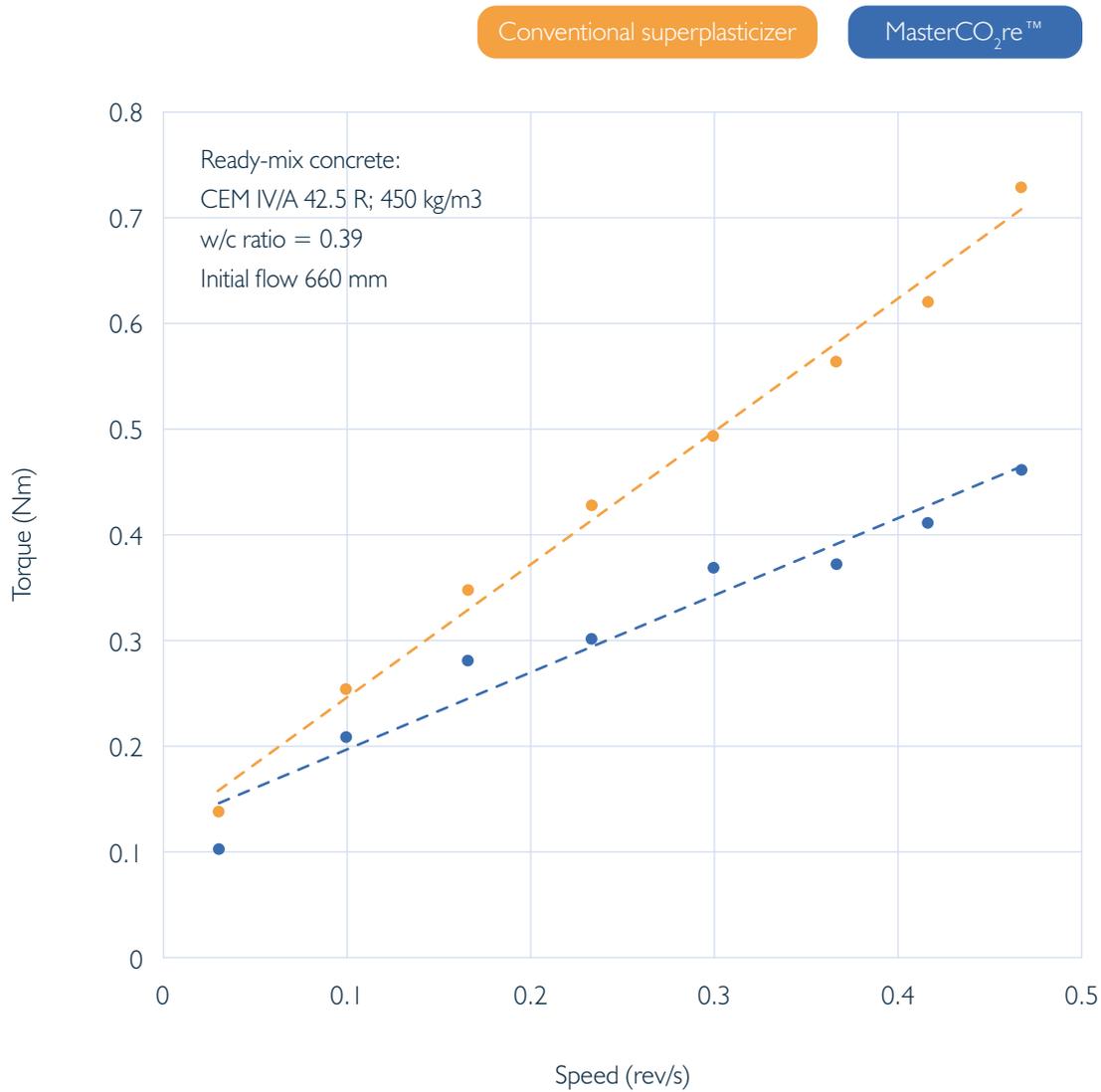
Concrete mix with  
MasterCO<sub>2</sub>re™ :

**CEM II/B-LL 32.5,  
307 kg/m<sup>3</sup>**

# MasterCO<sub>2</sub>re™ application case 2:

## Superior rheology in ready-mix

Superior rheology (low plastic viscosity) of MasterCO<sub>2</sub>re™ compared to commercially available technologies and measured with a professional rheometer in the field.



Rheological behaviour measured with EBTv rheometer from Schleibinger Geräte (Bingham by Reiner - Rivlin model)





MasterCO<sub>2</sub>re™ application case 3:

**CO<sub>2</sub> reduction combined with superior early strength in precast**

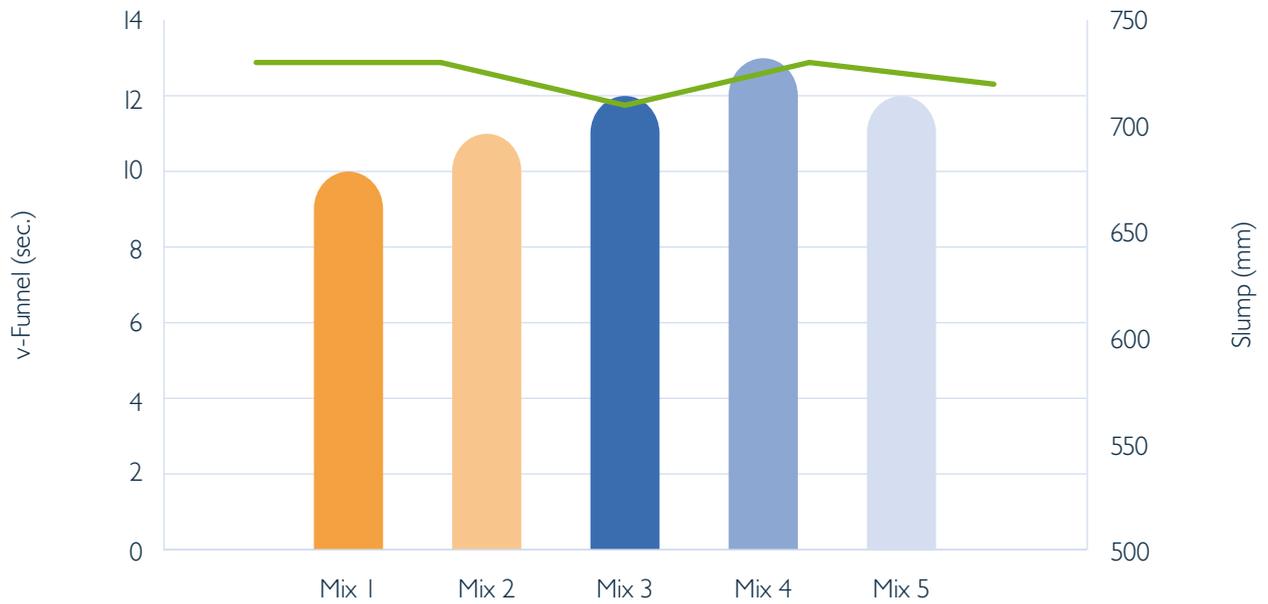
Raw Materials	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Sand 0-4 mm	950	950	965	965	965
Coarse aggregates (d. max 20 mm)	780	780	790	790	790
Limestone filler	100	50	130	80	100
CEM I 52.5 R	400	—	370	—	—
CEM II/A-LL 52.5 R	—	450	—	420	400
Water	190	190	175	175	175
Conventional superplasticizer	3.00	3.60	—	—	—
MasterCO <sub>2</sub> re™	—	—	2.80	3.60	4.80
Master X-Seed	—	—	—	—	8.00



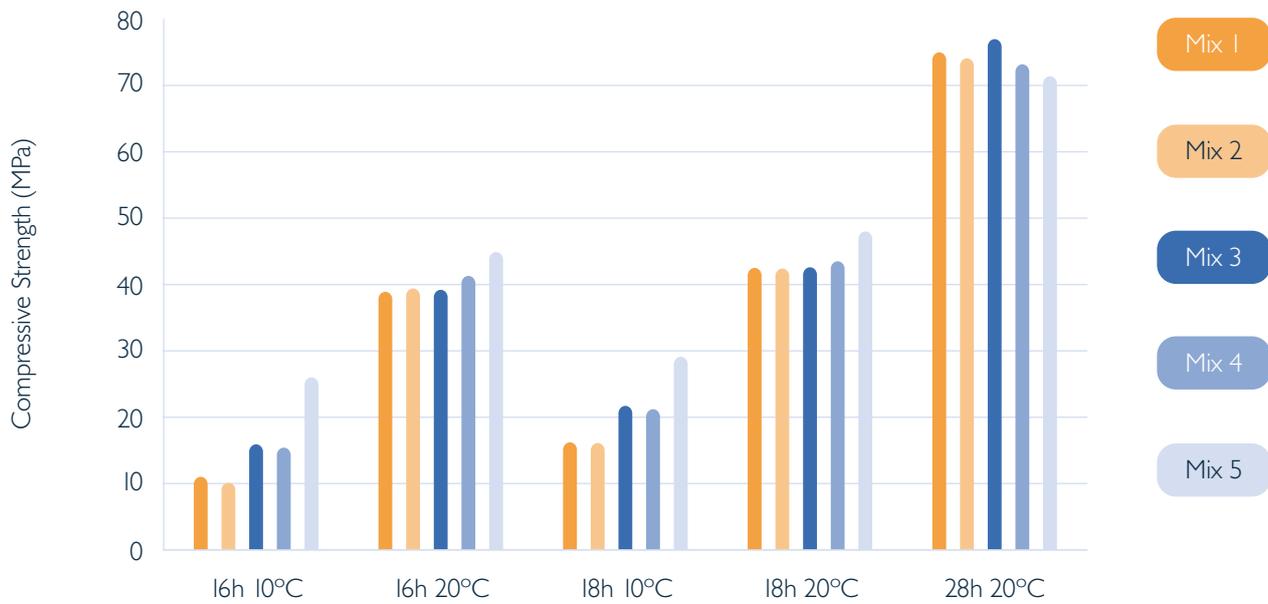
## Fresh state properties

Conventional superplasticizer

MasterCO<sub>2</sub>re™

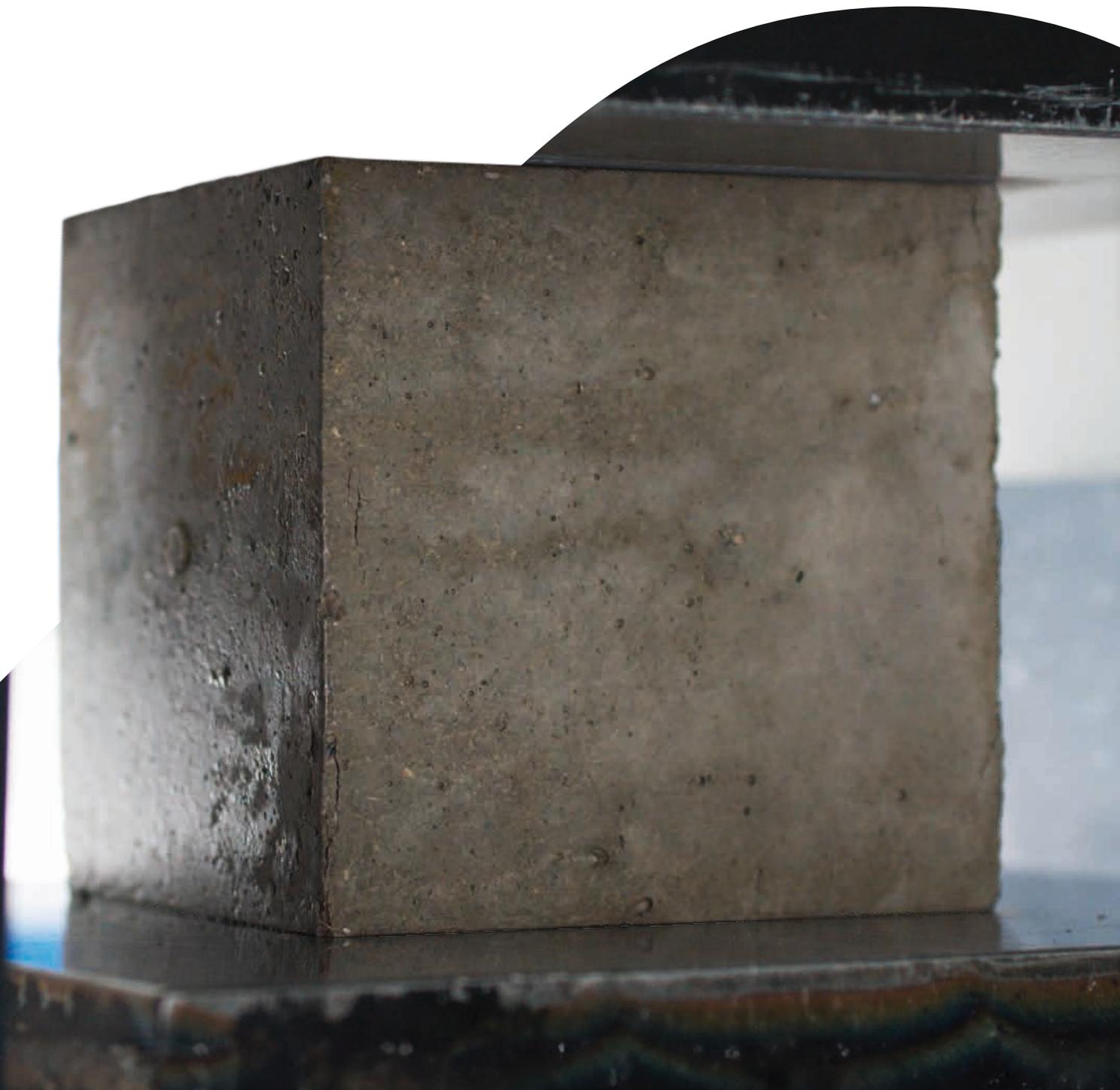


## Compressive strengths



	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
 kg CO <sub>2</sub> e/m <sup>3</sup>	389 (0%) 388.9 kg CO <sub>2</sub> e/m <sup>3</sup>	380 (-2.3%) 380.1 kg CO <sub>2</sub> e/m <sup>3</sup>	366 (-6%) 365.7 kg CO <sub>2</sub> e/m <sup>3</sup>	360 (-7.4%) 360.1 kg CO <sub>2</sub> e/m <sup>3</sup>	352 (-9.5%) 352.1 kg CO <sub>2</sub> e/m <sup>3</sup>
 Water saved* for daily consumption of	—	0 people (0%)	4 people (-7.9%)	4 people (-7.9%)	4 people (-7.9%)

\* Assumption per person = 3.5 l/day



## Pushing the limits with our new intelligent cluster system technology

Our flagship project EDGE East Side Berlin, meets the highest environmental and technological standards and represents the optimum that can already be realized today within the framework of the German concrete standard. With the help of our advanced admixture solutions considering our intelligent cluster system (ICS) technology, a high-performance concrete mix with about 50% less CO<sub>2</sub> compared to the industry reference value of C35/45, was developed and successfully applied. Despite the high concrete and air temperatures of up to 35°C, the concrete was easily pumped over a total length of 275m and up to a height of 140m thanks to the superior robustness of our ICS admixture solution. The EDGE East Side Berlin Tower is a prime example of what can already be realized today – and even more, is achievable with advanced admixture technologies when moving outside normative standards and breaking through existing boundaries.

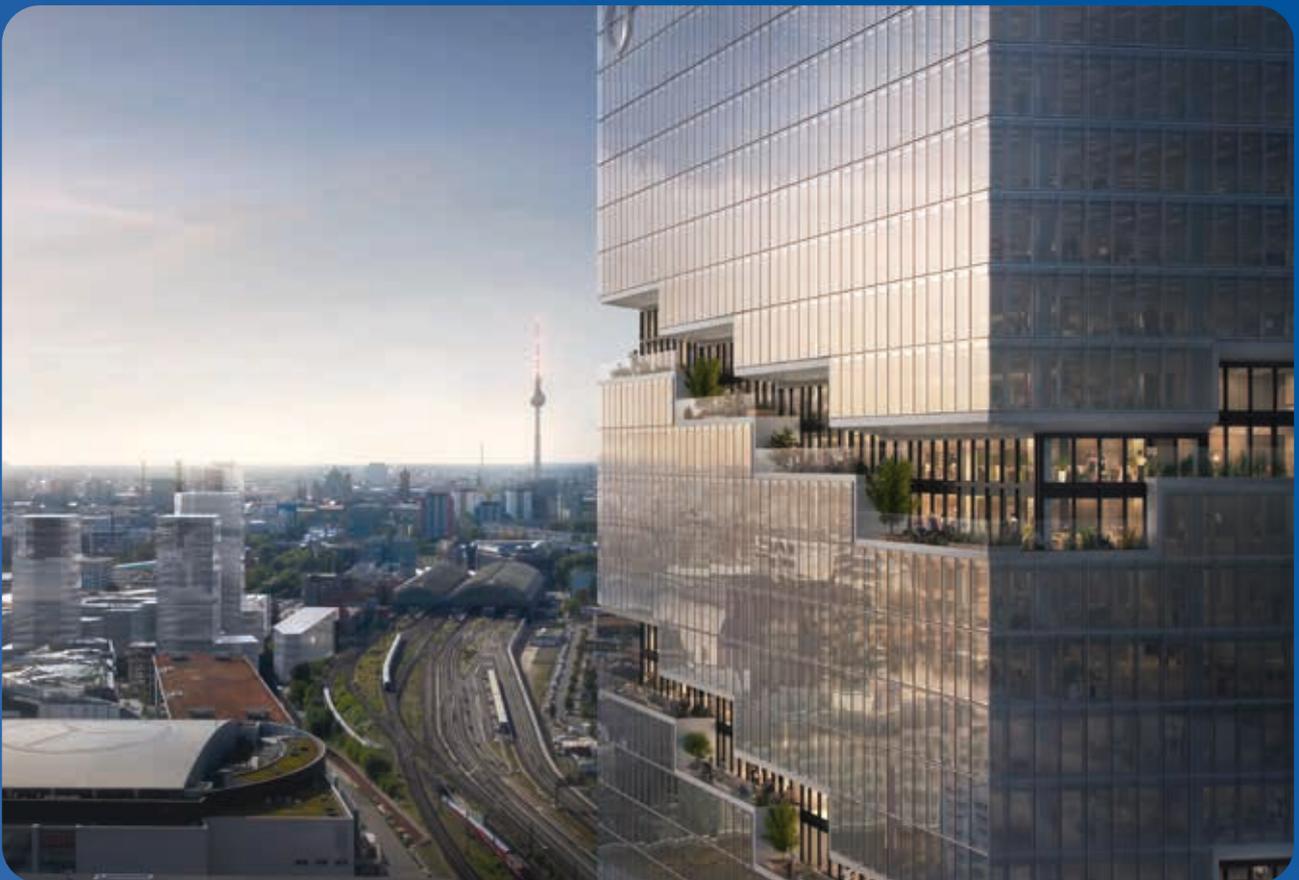
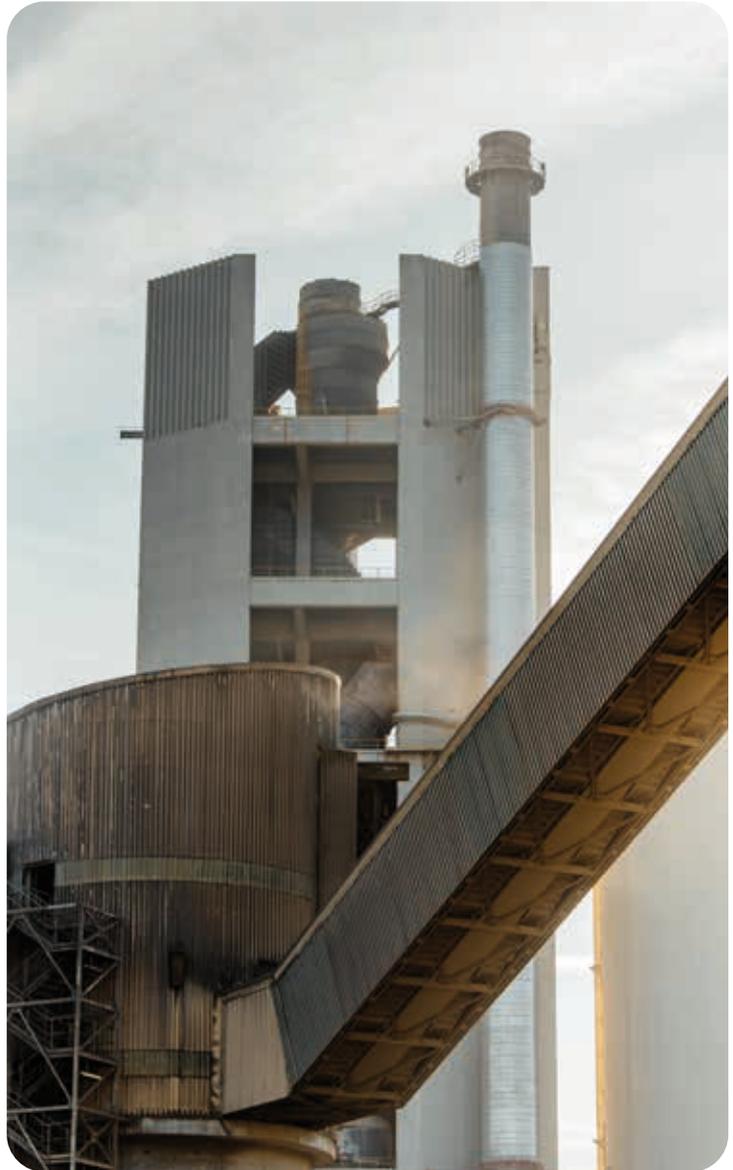


Photo source: bloomimages

## Promsa – Cementos Molins

Our reference in Barcelona (Spain)



**Watch Promsa –  
Cementos Molins' success story**

[info.master-builders-solutions.com/masterco2restory](https://info.master-builders-solutions.com/masterco2restory)



# ECO<sup>2</sup>NOW™

## Concrete Calculator: Cut down CO<sub>2</sub> & Costs

Comparing and optimizing concrete mixes is part of our value proposition. Our ECO<sup>2</sup>NOW™ concrete calculator makes CO<sub>2</sub> emissions tangible while considering your overall costs and performance.

### **Identify potential cost and energy savings**

Calculate your formulation and heat treatment costs for concrete and achieve significant savings through concrete technology measures.

### **Evaluate embodied carbon in concrete and its saving potential**

Get important data on your carbon footprint of the analyzed concrete to make decisions on certifications or detailed verification management.

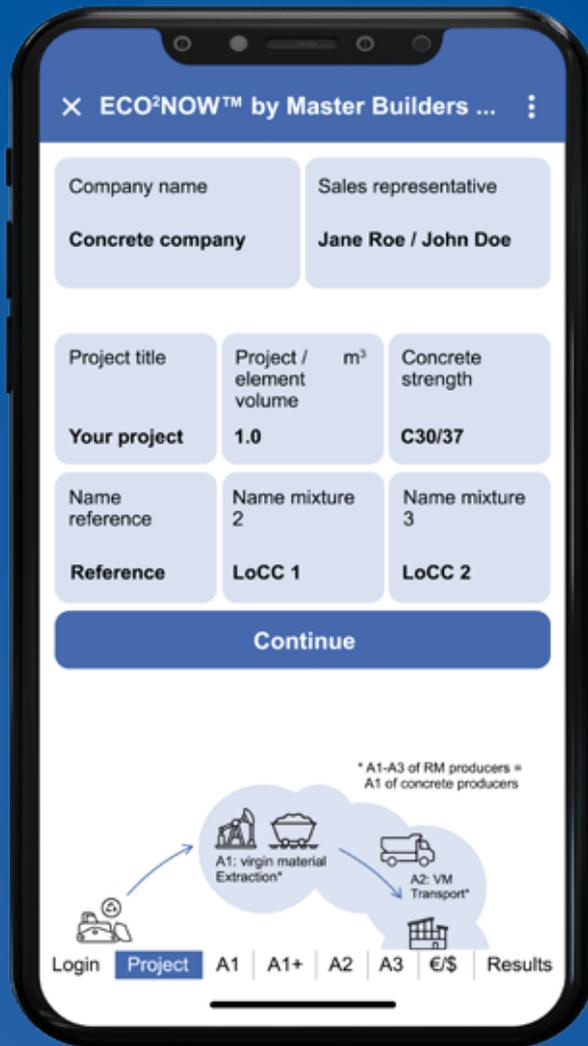
### **Detect water saving potential**

Optimizing your concrete mix with high-performance admixtures can result in significant water content savings.

### **Contact us for your individual ECO<sup>2</sup>NOW™ report to spot the difference**

Compare different concrete formulations with the ECO<sup>2</sup>NOW™ concrete calculator and see the positive influence of our cutting-edge technologies on your concrete properties.

# ECO<sup>2</sup>NOW™ Concrete Calculator



## Unlock Hidden Savings with MasterCO<sub>2</sub>re™

We can calculate the significant savings in CO<sub>2</sub> emissions and drinking water through mix design optimization. Contact our experts today.



# Master Builders Solutions for the Construction Industry

## **MasterAir®**

Complete solutions for air entrained concrete

## **MasterCast®**

Solutions for the manufactured concrete product industry

## **MasterCem®**

Solutions for cement manufacture

## **MasterCO<sub>2</sub>re™**

Solutions for low-clinker concrete

## **MasterEase®**

Low viscosity for high performance concrete

## **MasterFinish®**

Solutions for formwork treatment and surface improvement

## **MasterFiber®**

Comprehensive solutions for fiber reinforced concrete

## **MasterGlenium®**

Solutions for high performance concrete

## **MasterKure®**

Solutions for concrete curing

## **MasterLife®**

Solutions for enhanced durability

## **MasterPel®**

Solutions for hydrophobization, anti-efflorescence and surface protection

## **MasterPolyheed®**

Solutions for mid-range concrete

## **MasterPozzolith®**

Solutions for water-reduced concrete

## **MasterRheobuild®**

Solutions for high strength concrete

## **MasterRoc®**

Solutions for underground construction and surface improvement

## **MasterSet®**

Solutions for set control

## **MasterSphere®**

Solutions for guaranteed freeze-thaw resistance

## **MasterSuna®**

Solutions for sand and gravel in concrete

## **MasterSure®**

Solutions for extraordinary workability retention

## **Master X-Seed®**

Advanced accelerator solutions for concrete

## Unveil the Power of MasterCO<sub>2</sub>re™ : Intelligent Cluster System for Low-clinker Concrete Production

[info.master-builders-solutions.com/en/masterco2re](http://info.master-builders-solutions.com/en/masterco2re)



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