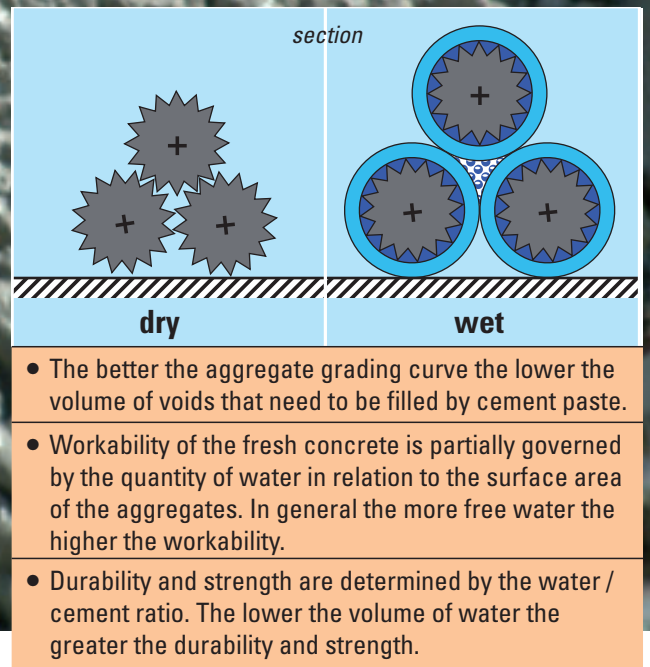


# Construction Chemicals: Technology to Optimise Concrete





## Fundamentals of mix design optimisation

**Admixtures simultaneously improve the concrete quality and cost-effectiveness:**

**This overview on the factors that influence the concrete quality has been compiled by MC.**

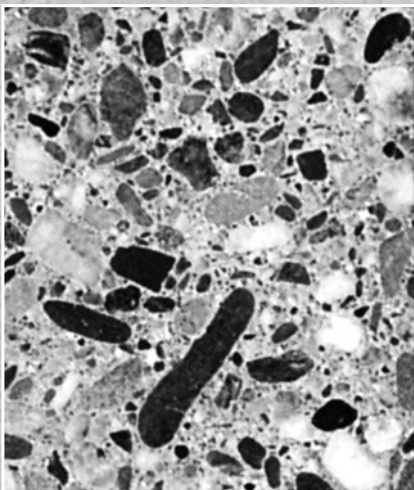
**It covers the most important aspects of concrete mix design as demanded by contemporary concrete specifications.**

## Mix Design Optimisation

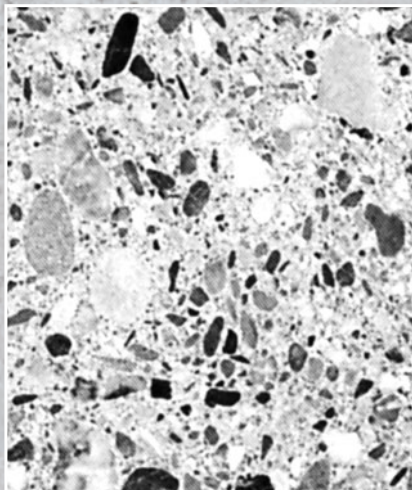
To produce concrete that has the desired workability, from plastic to flowing to self-compacting, all the gaps and voids between the aggregate particles must be filled with the cement paste. Additional cement paste is also needed to act as a “lubricant” and facilitate the ability of the aggregates to move easily around each other in the fresh state. To achieve the desired mechanical properties (compressive, tensile strength etc) of the hardened concrete the mix must be optimised by balancing the demand for water for workability while minimising the water to lower the water cement ratio. (w/c)

*Cross-section through concrete made from aggregates complying with grading curves A 16, B 16 and C16*

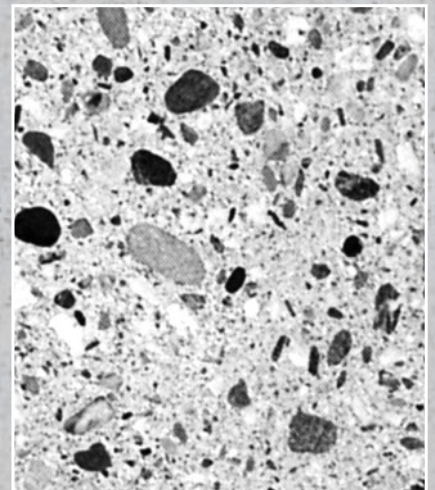
**A 16**



**B 16**



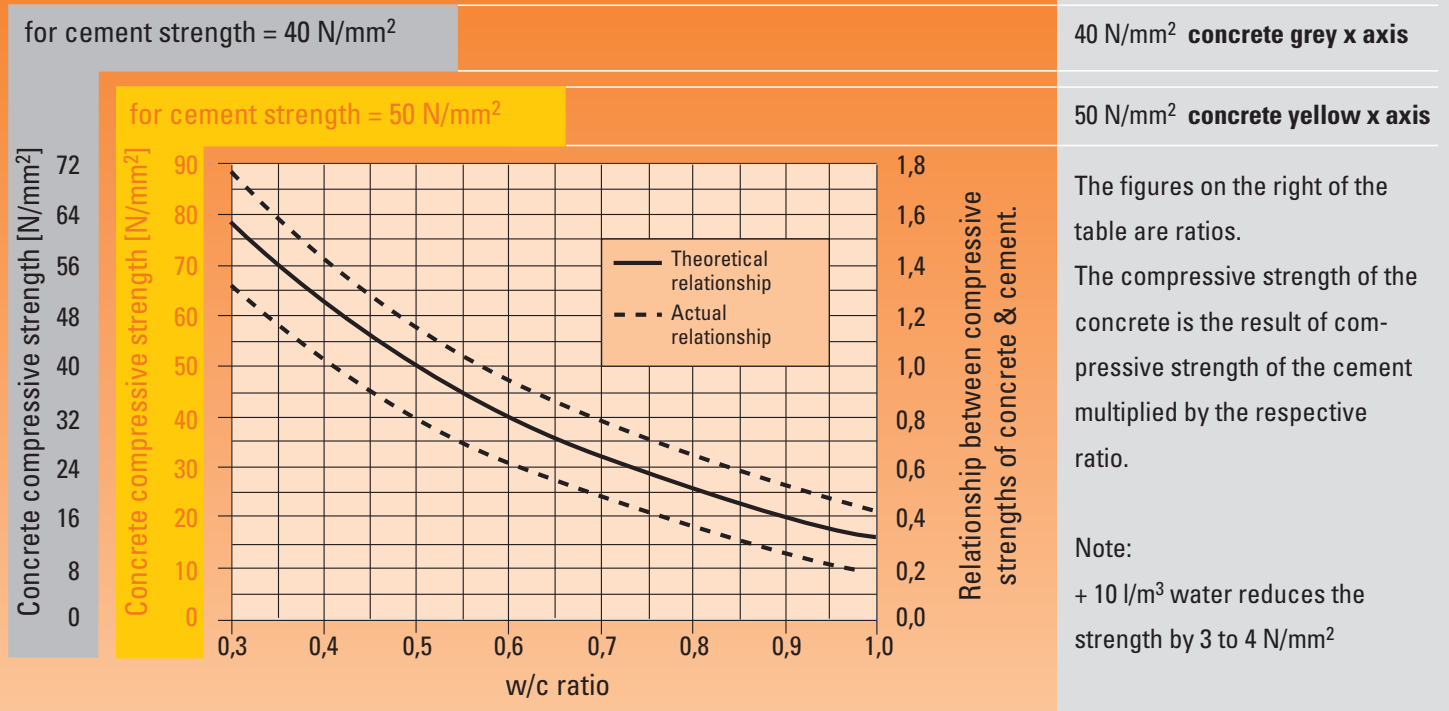
**C 16**





# 28 day\* concrete strengths based on 15 cm cubes

\*7 days wet + 21 days dry



## Technical-economic Optimisation

The objective of each concrete design is to achieve optimal workability coupled with high durability.

For this technical optimisation MC plasticizers from the Centrament range or super-plasticizers from the Muraplast range have proved to be ideal.

They achieve the desired improvement in workability at a low w/c value thus achieving high durability.

The products from the Muraplast range consist of standard admixtures for a broad range of applications.

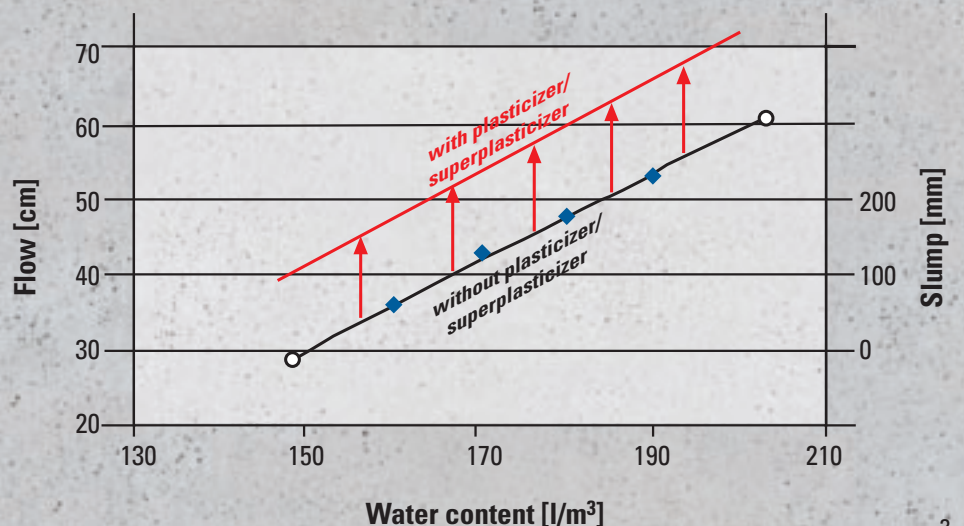
In addition, the range contains high-performance admixtures based on polycarboxylate ethers, which have been tailored to suit specific application areas.

- Precast concrete elements requiring high flow characteristics and rapid strength gain
- Ready-mixed concrete needs high workability for extended periods and a set retardation



## Workability against water content

\*Measured by slump or flow





## Basic Plasticizer Effects

Due to natural positive to negative attraction between the fine particles they tend to agglomerate in contact with water. The water is then trapped and not available for hydration and workability. The addition of an admixture changes the particle charges and the agglomerates are broken down and the water released. **An increase in workability is thus achieved.**

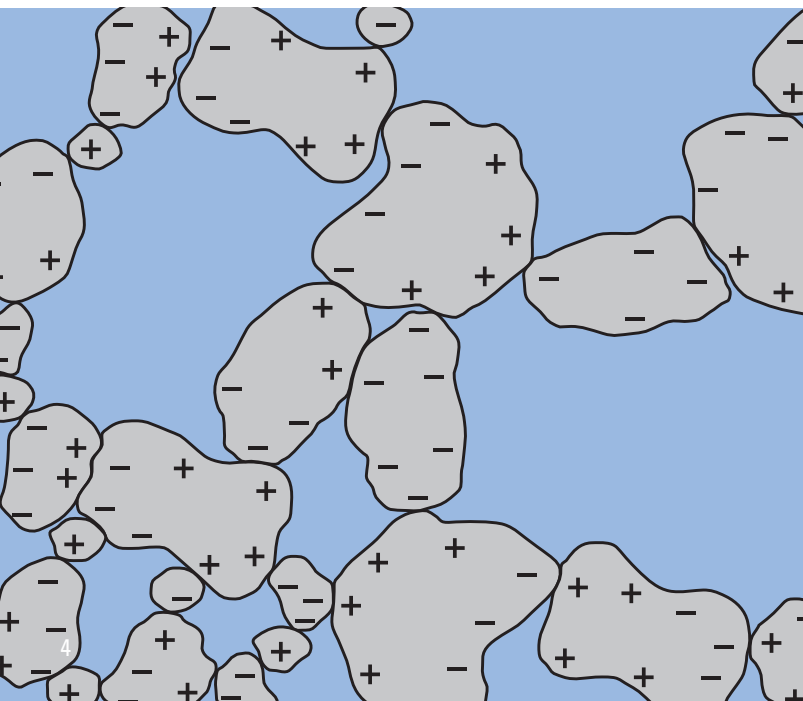
The fine cement particles improve the packing density:

**More lubricating paste becomes available.**

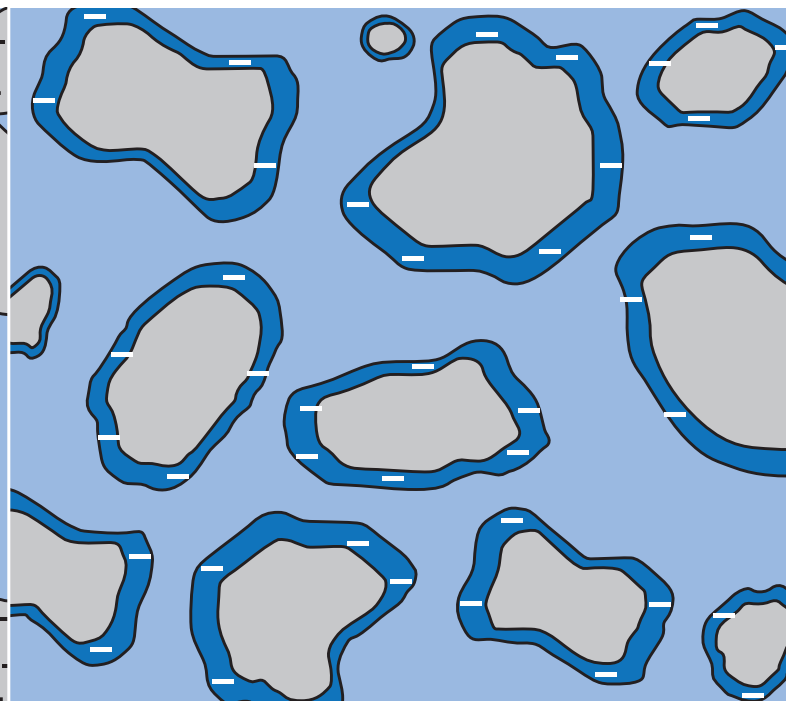
A larger surface area for the bonding of the individual particles is available:

**Improved hardened concrete properties are achieved.**

*Agglomeration due to particle attraction*



*Break down of agglomerates with the addition of an admixture*

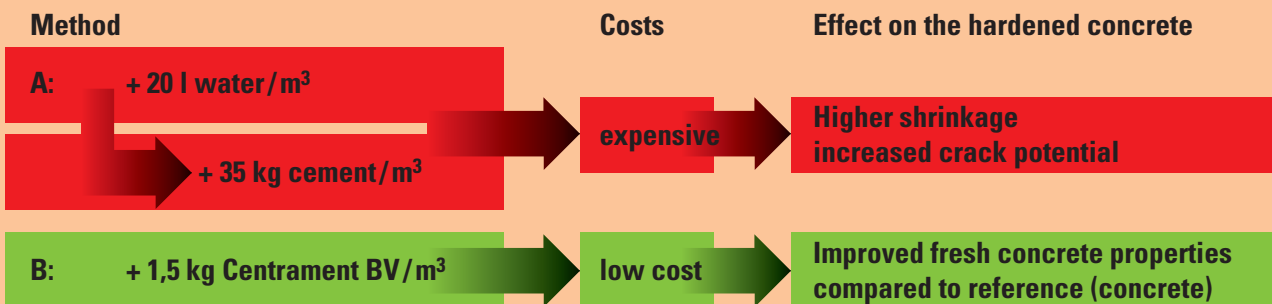






## Cost reduction by using plasticizers to increase workability

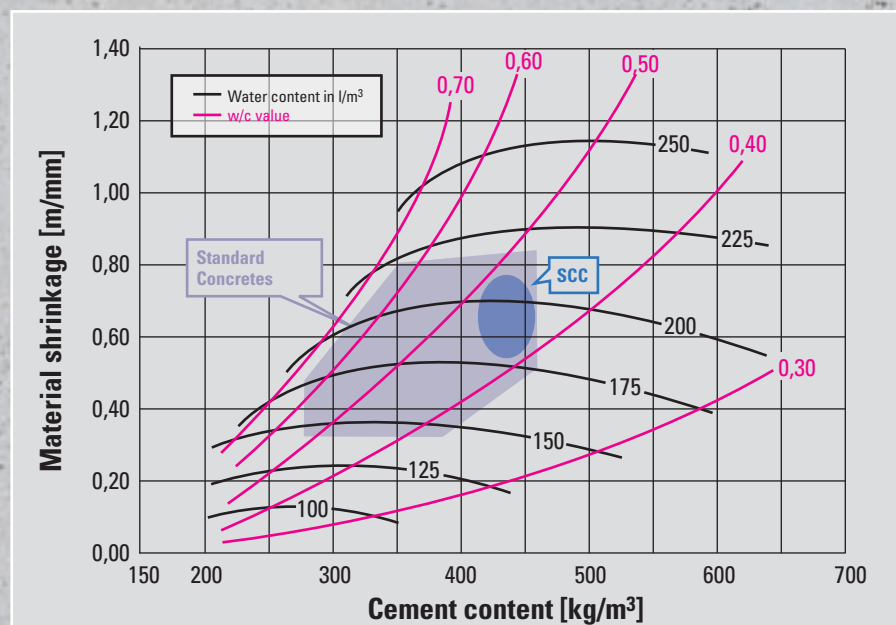
**Achieving 10 cm more slump  
Comparison of concretes with 0.6 w/c**



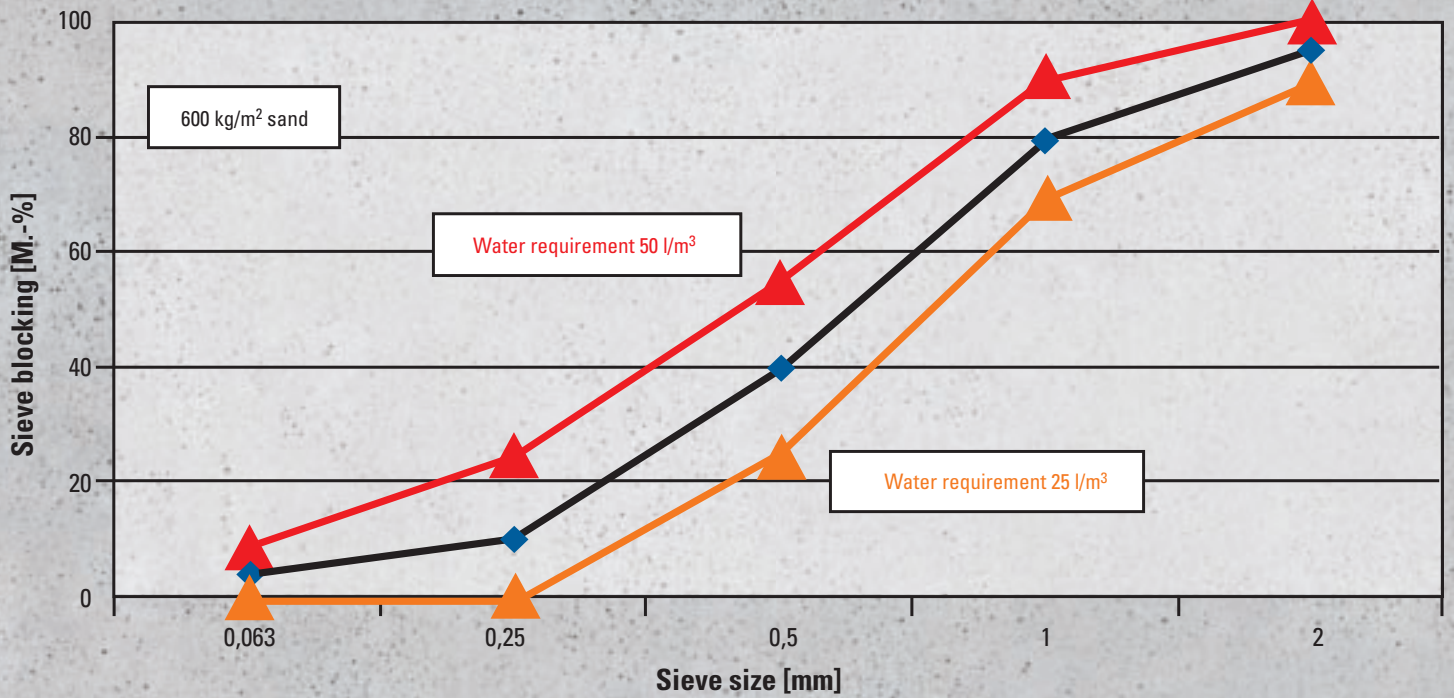
### Water content – shrinkage

The table, according to Czernin, clearly shows the influence of water content on the degree of shrinkage

This means that a water content reduction using a plasticiser BV/FM has a positive effect on the shrinkage behaviour of the hardened concrete.



## Water requirements based on the sand grading



## Robust mix designs are imperative for all concretes

### Guide values for variations in the sand

Increasing the amount of  $\leq 0.25$  mm particles by 1% means an increase in water demand of 1 l/m<sup>3</sup>.

### Guide values for the reduction of the compressive strength while increasing the water cement ratio.

At a given w/c an increase of 10 l/m<sup>3</sup> water reduces the compressive strength by approx. 1 N/mm<sup>2</sup>.

### Carefully estimate the variations of the raw materials:

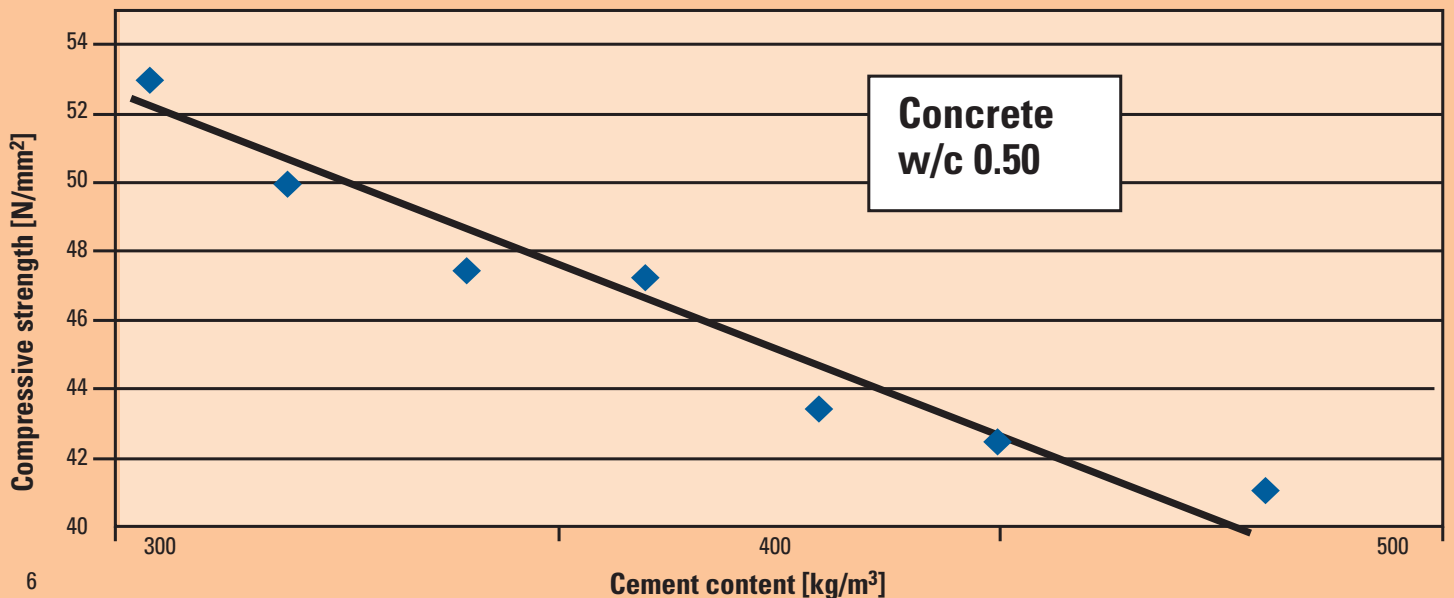
the variation limits should preferably be agreed with the supplier in order to achieve a uniform result.

### Comply with the pre determined water demand of the cement and aggregate:

No water must be added on site.

**The more uniform the raw materials, the better the concrete.**

## Compressive strengths v cement content at a fixed 0.5 w/c







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We develop the technology  
for reliable, durable  
quality concretes.**

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### **We have the right solution for any task**

<b>Requirement</b>	<b>Solution</b>
• Plasticizing for good workability	<b>Centrament</b>
• w/c reduction for increased durability & strength	<b>Muraplast / Centrament</b>
• Air voids for improved freeze / thaw resistance	<b>Centrament Air</b>
• Accelerators for cold weather concreting	<b>Centrament Rapid</b>
• Retarders for longer workability	<b>Centrament Retard</b>
• Foamed concrete	<b>Centripor SK</b>
• Stabilizer to improve the homogeneity	<b>Centrament Stabi</b>

## Quality and competence for every requirement

- Admixtures/Additives for concrete and mortar
- Release agents and curing compounds
- Concrete repair & protection
- Grouting compounds
- Waterproofing for building structures
- Screed systems
- Oxal restoration for old buildings
- Joint sealants

Highly developed product systems and competent services from one source: As practically-oriented developer of innovative construction materials MC-Bauchemie also offers its customers quality consulting and advice founded on years of experience in the area of concrete Improvement, protection and repair.  
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