Construction

Concrete Applications

Mineral Admixtures

THINKING OF TOMORROW

Mineral Admixtures for Concrete Applications

Omya has a long history of success with Betocarb and Betoflow in concrete applications. With new requirements and sustainability topics becoming more and more important, Omya has further extended its portfolio of functional fillers. Today, Omya offers a broad range of products and expertise for technical concrete applications including SCC, UHPC, architectural concrete, 3D printing, shotcrete, eco concrete, lightweight and heavyweight concrete.

Focusing on the required characteristics of the final products, Omya adds value throughout its range of mineral admixtures based on high purity GCC, Ground Calcium Carbonate (>90%). In technically complex systems such as SCC or UHPC, Omya's mineral plasticizers provide strong benefits, such as an improved water/cement ratio, increased stability towards segregation and optimization of the chemical admixture efficiency. Omya's mineral accelerator is dedicated to speeding up the hydration process and therefore increases early strength development while having no negative influence on final strength. This is appreciated in applications like 3D printing, shotcreting, and eco concrete.

Mineral Plasticizers

Betocarb HP is a mineral product based on calcium carbonate that optimizes the fines content (<125 µm) to prevent bleeding and segregation of SCC. It also improves the color and surface texture of architectural concrete.

Betocarb F is a fine ground calcium carbonate that reduces porosity and improves the early age strength of technical mortar and high strength concrete.

Betoflow D is dedicated to UHPC and 3D printing to enhance flow behavior and reduce the water/ cement ratio. Due to its low water demand, Betoflow D can be used in combination with SCM and pigments to optimize the chemical admixture content.

Mineral Accelerator

Betocarb UF is a pure, ultrafine ground calcium carbonate acting as a mineral accelerator by providing nucleation sites. It is recommended for use in eco concrete, UHPC, shotcrete, and 3D printing applications.

Key Benefits

- ✓ Improved particle packing & stability
- ✓ Enhanced water to cement ratio
- ✓ Optimized admixture efficiency
- ✓ Increasing flowability
- ✓ Removed bleeding/ segregation
- ✓ Optimized performance costy
- ✓ Contribution to a more sustainable concrete formulation

Mineral additives with Low Carbon Footprint

Calcium Carbonate only has a carbon footprint of 62 kg emitted per ton of natural ground calcium carbonate (GCC) produced. **Omya's Mineral Admixtures** can therefore lower the carbon footprint of your dry mortar application considerably compared to formulations without **Omya Mineral Admixtures**.

Natural products for sustainability

How to find the right product for your application

Self Compacting Concrete (SCC)
Mineral Plasticizers (Betocarb HP, Betocarb F) optimizes the packing of the aggregate skeleton (increased paste content, filled voids of the sand) while improving the workability. This yields higher rheological stability, reduced segregation and better flowability.

Ultra High Performance Concrete (UHPC)
Optimization of water/ cement ratio, mineral binder content (cement + SCM), flow and packing enhancement by using selected GCC, e.g. Betocarb HP, Betoflow D, Betocarb UF.

Architectural Concrete
Betocarb products offer a bright, white color yielding advantages for colored concrete. By closing/ filling the pores/ voids, the concrete gets a very smooth surface, resulting in very aesthetic surfaces (exposed concrete).

Eco Concrete
The synergy of selected GCC like Betocarb HP, Betoflow D, Betocarb UF with SCM (fly ash, blast-furnace slag, silica fume, calcined clay) enhances the water/cement ratio, flow, packing and resistance to segregation.

3D Printing/ Shotcrete
Our mineral accelerator Betocarb UF provides nucleation sites that favor and accelerate the growth of cement hydrates. This results in a significantly improved early strength development. Betocarb UF works especially well for shotcrete in combination with aluminum sulfate accelerators. Our mineral plasticizers products increase the segregation resistance and stability of cementitious 3D printing formulations (“green strength”).

Lightweight Concrete
Using our lightweight fillers (Omyasphere series), the density of the concrete can be greatly reduced. This is interesting for large and heavy structures like bridges, skyscrapers. Omya lightweight fillers also improve the thermal insulation of the concrete. In addition, Betocarb HP is used as a mineral plasticizers to prevent segregation.

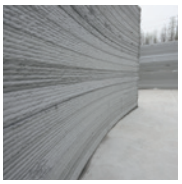
Heavyweight Concrete
For special applications where a high mass is required on a limited volume (e.g. ballast) our barite products can be used (granules and powders). Barite also offers improved shielding from electromagnetic radiation (applications in e.g. hospitals, laboratories, nuclear power plants).

SCC / Eco Concrete

UHPC

Architectural Concrete

3D Printing

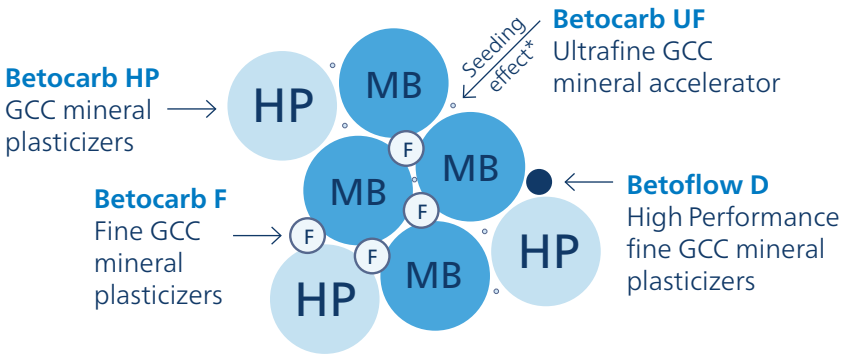


Shotcrete

Heavy-/ Light-weight Concrete

Generally, our mineral admixtures can be recommended for these applications:

Properties	Standard	Mineral Plasticizers			Mineral Accelerator
Applications	**Betocarb**	**Betocarb HP**	**Betocarb F**	**Betoflow D**	**Betocarb UF**
SCC / Eco Concrete		√ √	√		
UHPC		√		√ √	√
Architectural Concrete		√ √	√	√	
3D Printing		√		√ √	√ √
Shotcrete					√ √
Heavy-/ Lightweight Concrete	√	√			



MB = Mineral Binder

* Seeding effect: The very low particle size (meaning a large available surface) of the ground calcium carbonate Betocarb UF provides a high number of nucleation sites for the cement particles. It will not only fill the voids between cement grains, but also accelerate the hydration process and improve the workability, mechanical properties and durability through the dilution, nucleation and even chemical effects.

Optimize your formulation with Omya evaluation methods

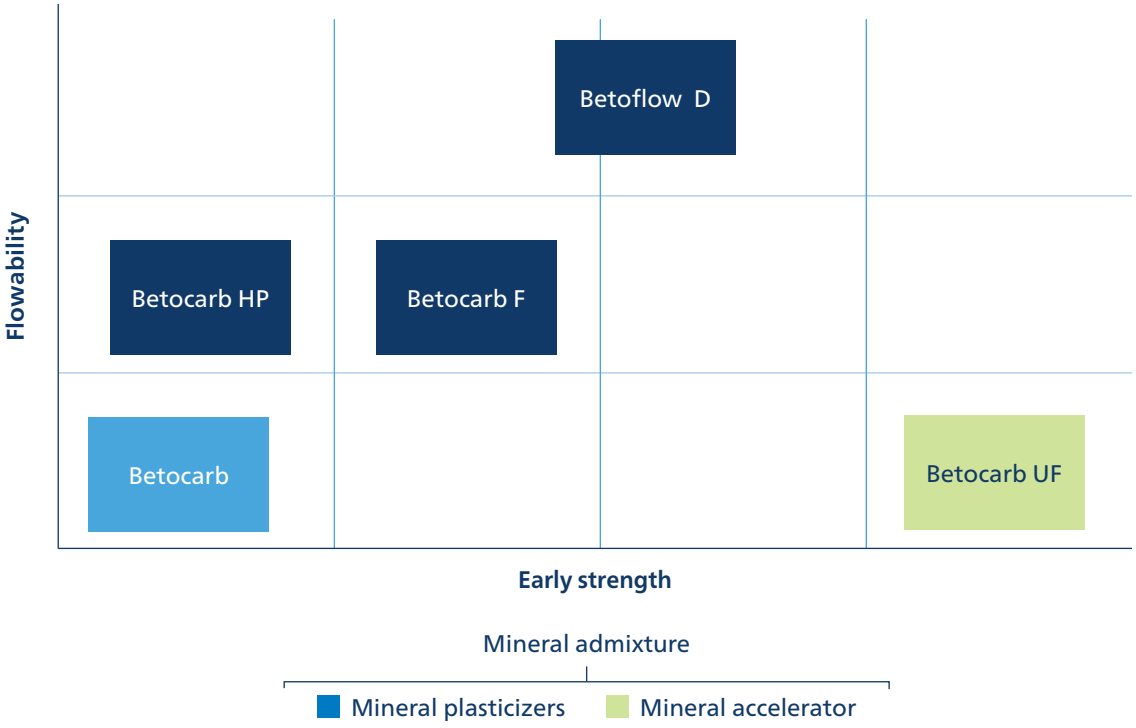
In order to clearly distinguish between the five product lines, Omya invented a series of performance evaluation methods,the so called LG methods (lab method for GCC). Generally, the following methods can be recommended depending on your application:

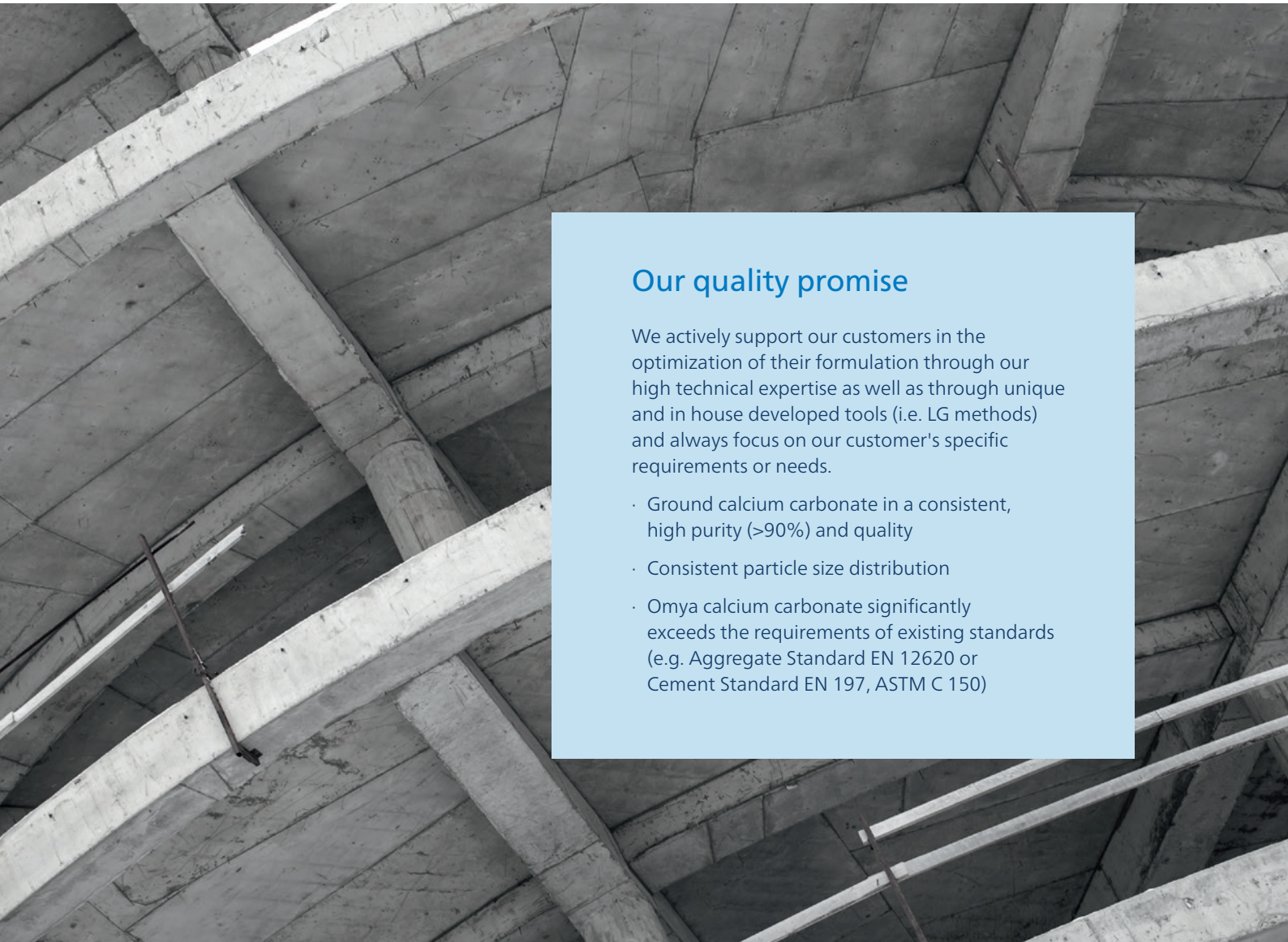
Applications	LG System	LG 16	LG 10	LG Pigment	LG 7
SCC/ Eco Concrete	√	√		√	√
UHPC		√	√	√	√
Architectural Concrete	√			√	√
3D Printing		√	√	√	
Shotcrete		√	√	√	
Heavy-/ Lightweight Concrete	√				

If you are looking for a specific parameter to enhance in your formulation, we can assist you by performing the following methods:

Benefits	LG Methods	Description
Packing, flow behaviour, resistance to segregation	**LG** System	In self-leveling systems, define the best proportion of GCC and fine GCC to obtain the optimal packing, flow behavior and resistance to segregation. Also useful to evaluate the compatibility of chemical admixture with cement.
Flow behaviour, admixture correction, strenght	**LG 16**	In self-leveling systems, evaluate the contribution of the mineral filler (fine GCC and SCMs) on the flow behavior, necessary chemical admixture correction and compressive strength of the mortars.
Flow behavior, mineral activity	**LG 10**	In a paste-like consistency mortar, measure the flow behavior and minerals contribution to the strength development (GCC, Fine GCC, UFGCC and SCMs) in combination with cement.
Pigment evaluation, flow behaviour	**LG Pigment**	In self-leveling systems, evaluate the pigment contribution on the flow behavior, necessary chemical admixture or Betoflow D adjustment. Useful to demonstrate the color enhancement by using GCC with LG System.
Risk of discoloration	**LG 7**	Place a slurry of GCC that is prepared with an acrylic polymer in a beaker and observe if the bleeding pushes some fine colored particles to the surface.

Product Positioning





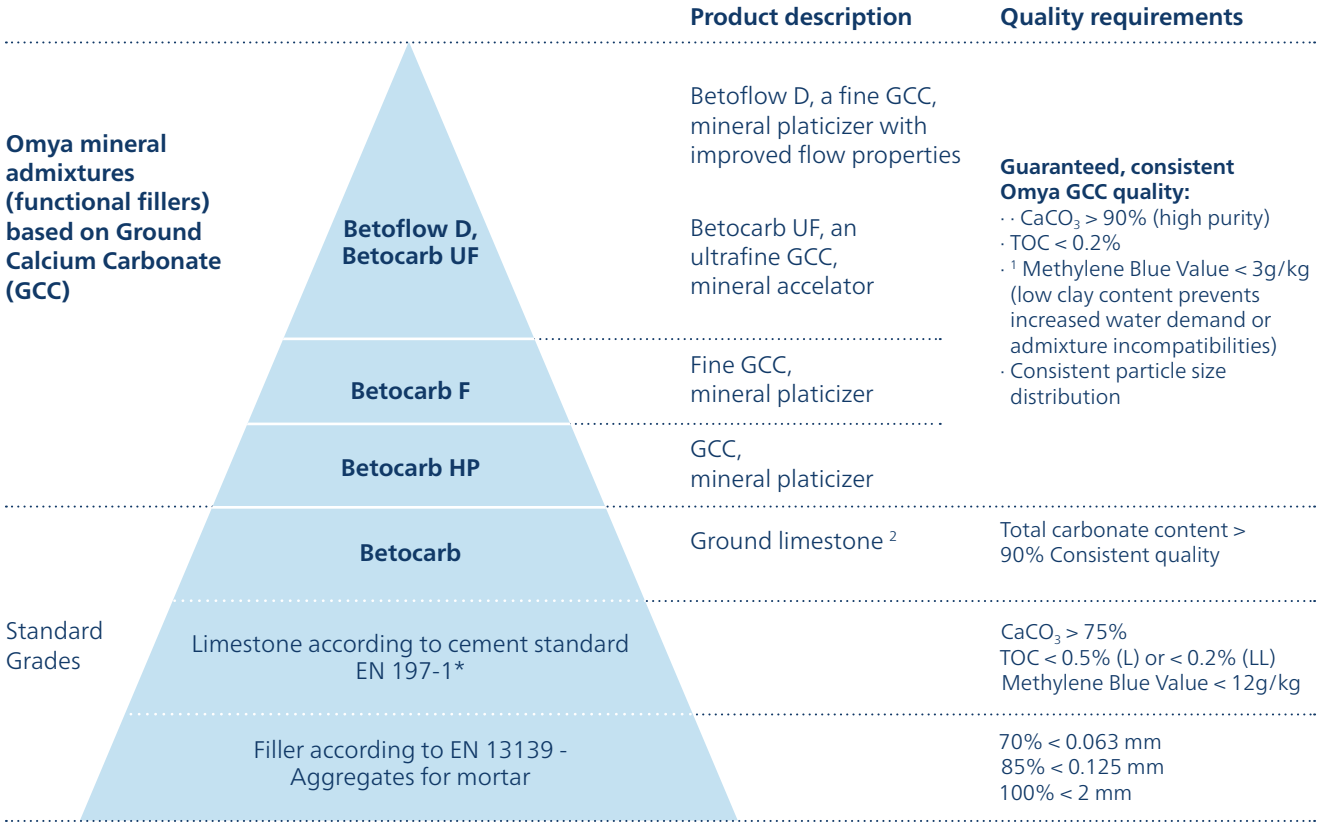
Our quality promise

We actively support our customers in the optimization of their formulation through our high technical expertise as well as through unique and in house developed tools (i.e. LG methods) and always focus on our customer's specific requirements or needs.

- Ground calcium carbonate in a consistent, high purity (>90%) and quality
- Consistent particle size distribution
- Omya calcium carbonate significantly exceeds the requirements of existing standards (e.g. Aggregate Standard EN 12620 or Cement Standard EN 197, ASTM C 150)

Mineral admixture value Pyramid

Overview of the right functional filler, according to your quality requirements



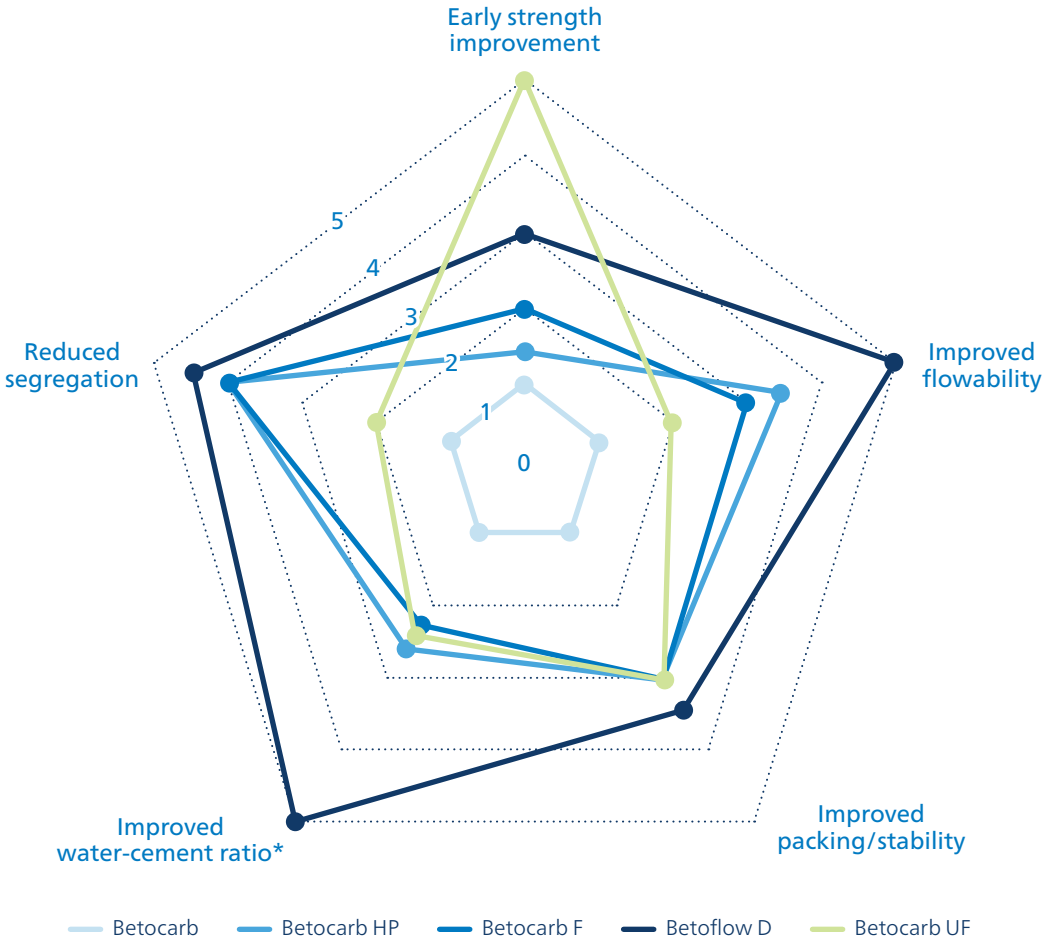
[2] In certain cases Dolomite

Limestone fillers are widely used in concrete and cement industry. However, the quality requirement of such limestone products strongly depends on the standard. According to the aggregate standard EN 12620 a "filler" only needs to fulfill certain requirements regarding grain size. The quality of limestone used for cement (L, LL types) is defined according to EN 197-1. There, limit values for the purity ($CaCO_3$ content), total organic carbon (TOC) and clay content (methylene blue value standards) are defined. These parameters play a very important role in the performance of the final product. The presence of clay minerals for example yields to strongly increased water demand and a risk of incompatibilities with chemical admixtures. Omya guarantees for its ground calcium carbonate (Mineral Admixtures) a consistent quality that greatly exceeds the standard requirements (see quality pyramid). The result is a vast performance improvement of your final product compared to the use of standard grades.

*EN 12620, EN 197-1: Examples of European Standards. Please ask your local contact for any other standards

1 Methylene Blue Value: Methylene Blue is a dye which absorbs on surfaces of clay particles. The methylene blue value [g/kg] represents the amount of dye which is absorbed by the sample and thus gives an indication about the clay content. Clays play an important role in mortar and concrete applications because they can heavily disturb the performance: the high surfaces of clays increase the water demand very strongly and can yield to incompatibility problems with chemical admixtures (e.g. PCE superplasticizers). Therefore the methylene blue value of the product (GCC) should be as low as possible (low clay content).

Positioning by characteristics



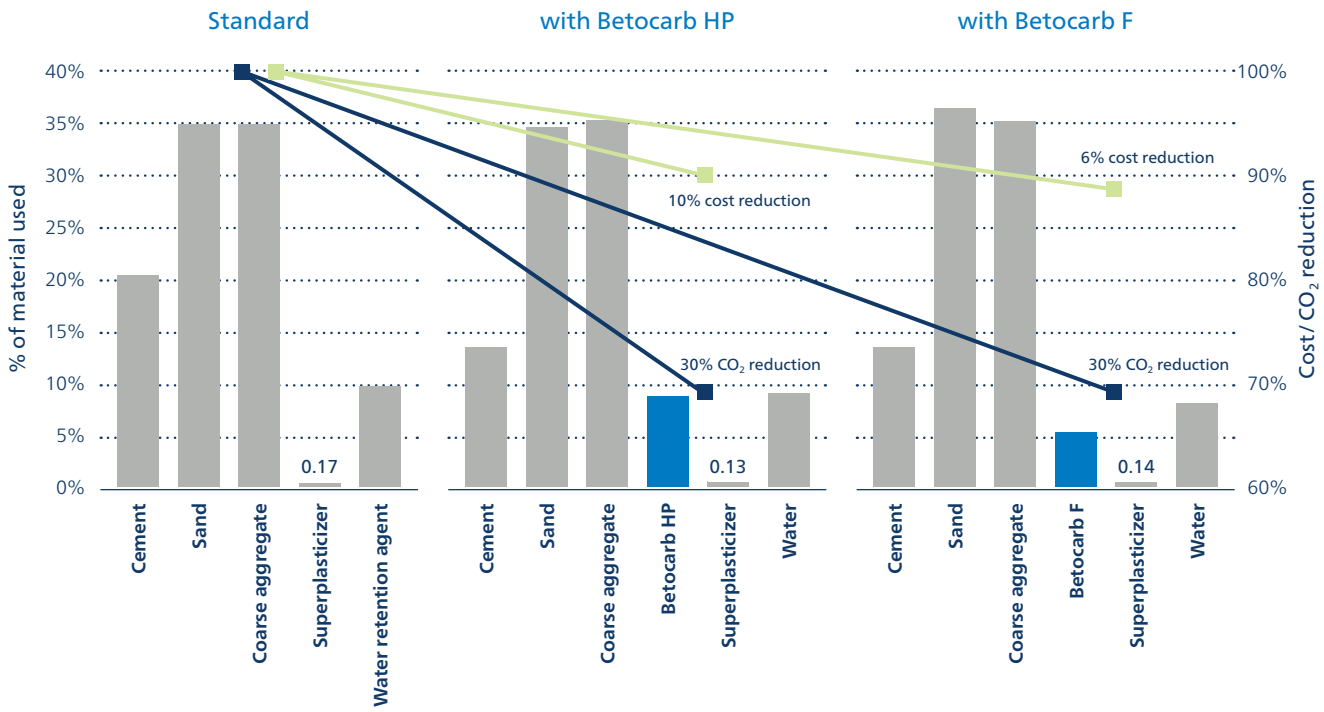
* Thanks to their purity, Omya products offer an excellent compatibility with additives used to improve the water cement ratio

Mineral Plasticizers:	Betocarb HP, Betocarb F and Betoflow D
Mineral Accelerator:	Betocarb UF
Standard Grade:	Betocarb

Lower the carbon footprint of your dry mortar formulation up to 30%*

Cost performance scenario and Impact on sustainability

Scenario: Self Compacting Concrete (SCC)

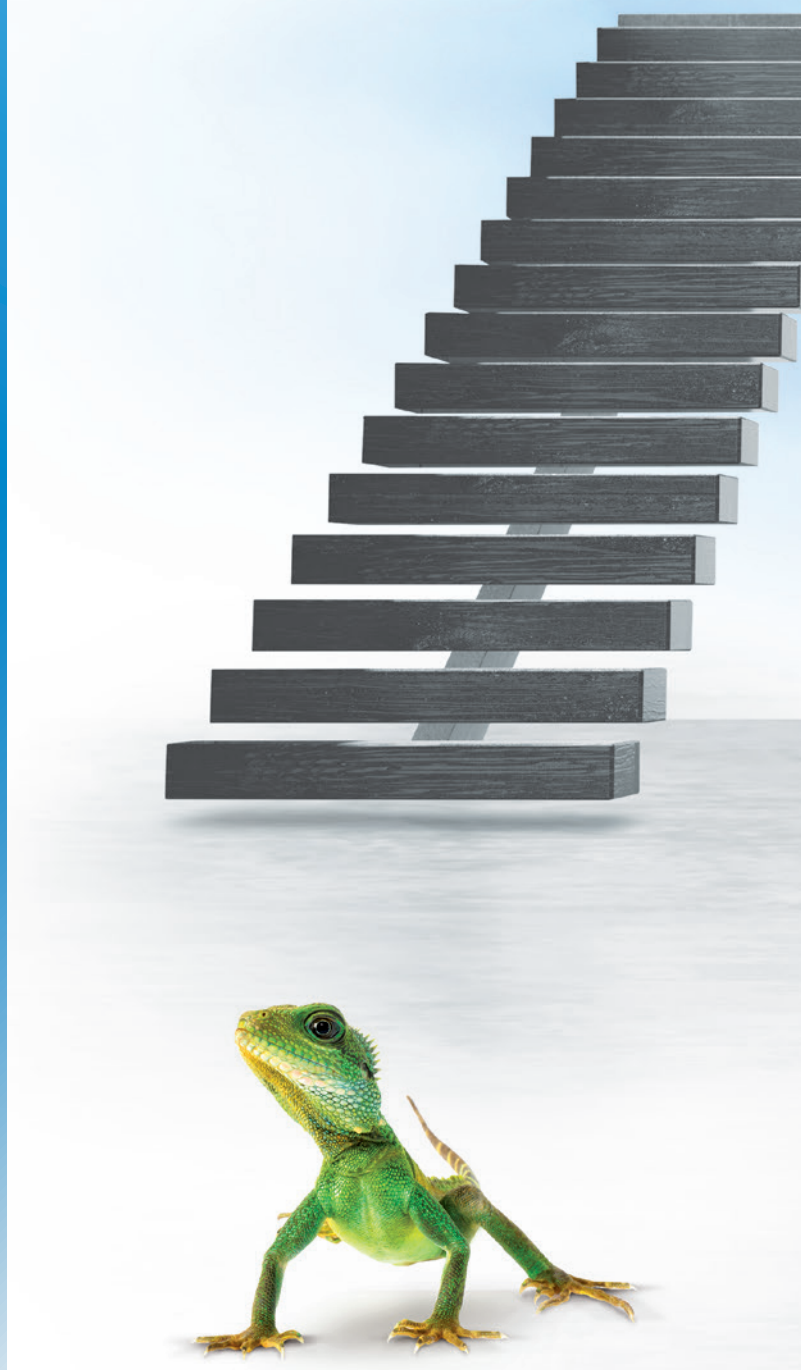


Performance improvement:

Increases segregation resistance, improves workability/ productivity, reduces costs & CO_2 footprint

The reference (left) represents a self compacting concrete formulated with cement only. By replacing the cement with an optimized quantity of Betocarb HP (middle) or Betocarb F (right) resistance to segregation is enhanced and proportion of cement and water as well as superplasticizer is reduced. In addition, formulation costs and carbon footprint of the mix design are significantly reduced.

*Sources:
Cement: MPA MPA (https://cement.mineralproducts.org/documents/Factsheet_18.pdf)
Sand, aggregate, water: Ecoinvent GCC: CCA the other constituents (chemical admixtures) are estimated.



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