



Sika[®] ViscoCrete[®] **Technology**



Innovation & Consistency | since 1910

Sika® ViscoCrete® Technology

...will change your construction durability dramatically!



The Venetian, Macau, China



Woodrow Wilson Bridge, Washington, USA



The Bergisel Jumping Stadium, Innsbruck, Austria

Concrete Technology

Significant water content reduction
results in enhanced durability
properties of the hardened concrete

The engineering of concrete structures is a continuous developmental process. Invention and development of new construction methods place ever higher demands on building materials. Concrete producers face this technological challenge daily alongside other factors such as economy, ecology, raw material and energy costs as well as increased logistical complexity. In the duration of the whole construction process time itself also becomes an increasingly important factor.

Sika® ViscoCrete® technology brings several innovative options to concrete mix design. A major characteristic is the capability to substantially reduce the water content of a mix. Achievement of lower water / cement ratios results in dramatically enhanced durability, induced by remarkably low concrete permeability. Application of more economical mix designs is another option, with optimisations yielding more ecological and resource-friendly mixes at constant concrete quality.

Sika® ViscoCrete® technology responds to the current trend to use flowable concrete types. The trend demands new admixture technologies, and **Sika® ViscoCrete®** offers solutions for production of flowable concrete types for ready mix, onsite production and for the precast concrete industry. The target is to produce concrete with high flowability sufficient for a period of time and with no negative side

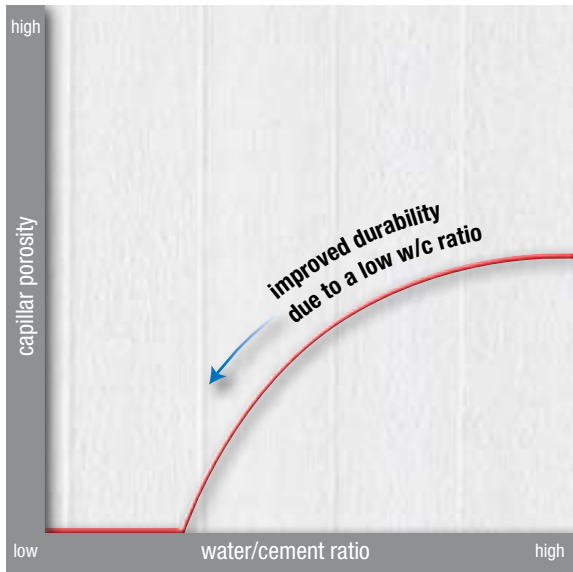
effects. Extended workability, controlled over several hours and without retardation is especially important for urban construction sites with congested traffic, or in remote areas resulting in long transportation times. **Sika® ViscoCrete®** technology also meets the challenge of ensuring target consistency in a concrete mix in high-temperature climates.

Strength gain is a present and continuous challenge in concrete technology and the construction business. All participants in the construction process desire achievement of sufficient early strength to allow formwork removal as quickly as possible, whether on construction sites or in production of precast concrete. In industrialised precast concrete production, early strength development is crucial because it influences the entire production process. High early strength development in concrete results in fast turnaround of formwork in a precast factory, in reduced or omitted heat or steam curing, more economical and ecological concrete mix designs, and earlier cutting of prestressing tendons.



Improved durability with low capillary porosity

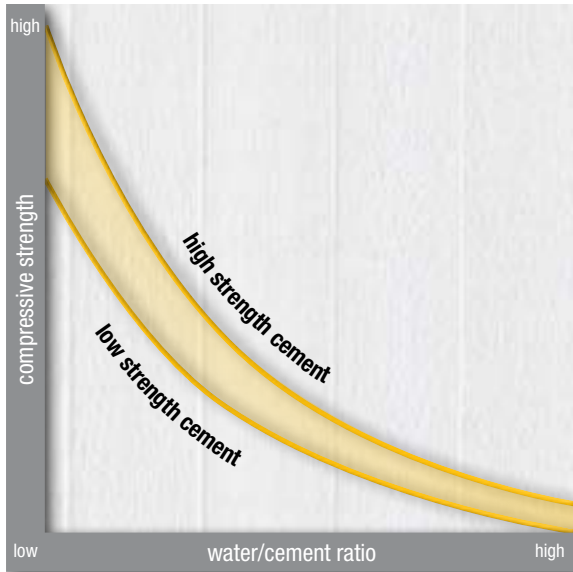
As durability and sustainability of constructions become more important, these properties must be considered in design of concrete. The water / cement ratio has a crucial influence on the impermeability of any concrete matrix. Application of **Sika® ViscoCrete®** can dramatically increase impermeability.



Enhanced strength due to lower water / cement ratio

Water / cement ratio and obtainable compressive strength stand in a materially factual relation. The water / cement ratio is therefore the decisive factor influencing strength gain.

Because of this relation, any strength increase in fresh concrete leads to reduced workability without addition of an admixture. On the other hand, targeting easy flowability of fresh concrete through addition of water consequently reduces compressive strength, and risking the durability of the hardened concrete.

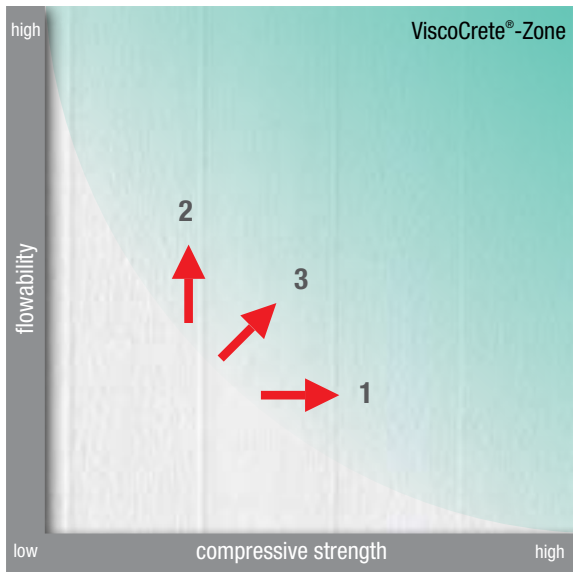


Sika® ViscoCrete® surmounts natural limits

With the application of **Sika® ViscoCrete®** it is possible to produce concrete which reaches substantially higher strength classes by reducing the water / cement ratio at a defined flowability (1).

Furthermore the design and production of a more flowable concrete at constant compressive strength can be realised with **Sika® ViscoCrete®** (2).

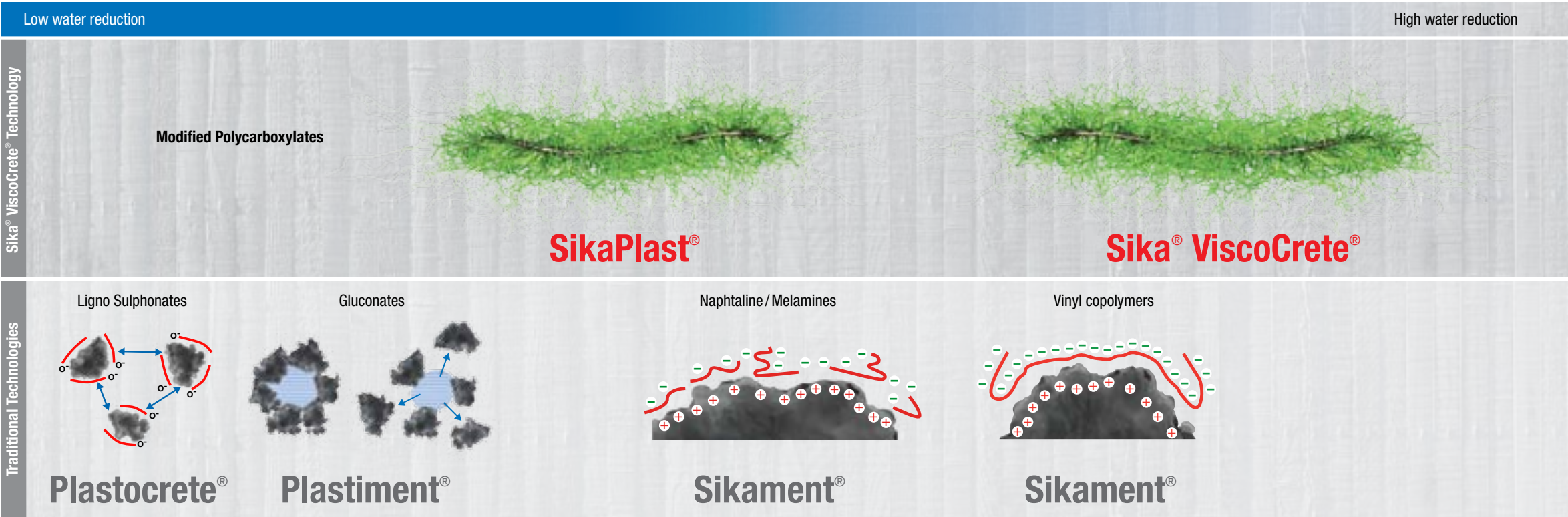
Last but by no means least with the **Sika® ViscoCrete®** technology it is possible to target both effects simultaneously: higher strength in conjunction with improved fresh concrete behaviour (3).





Polymer and Product Technology

Overview



Sika® ViscoCrete® Polymer Technology

Characteristics and Advantages of Polycarboxylate Ether Technology (PCE)

The major characteristic of polycarboxylate ether-based superplasticiser technology is their targeted polymer design to achieve specific concrete properties.

Characteristics that can be influenced are:

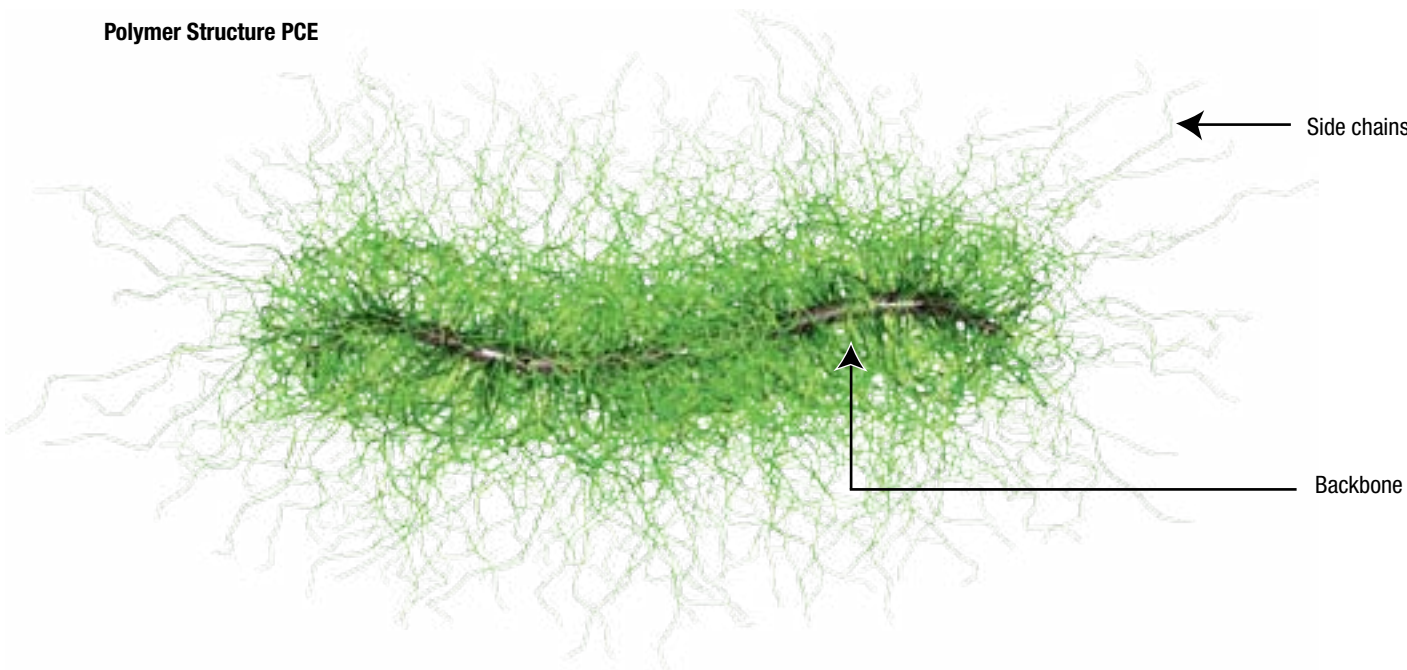
- Adsorption speed
- Water reduction with high initial liquefaction/workability
- Slump retention without retardation and subsequent fast strength development
- Early strength development with sufficient workability time
- Stickiness
- Stability / viscosity

Various combinations of these properties can be optimised.

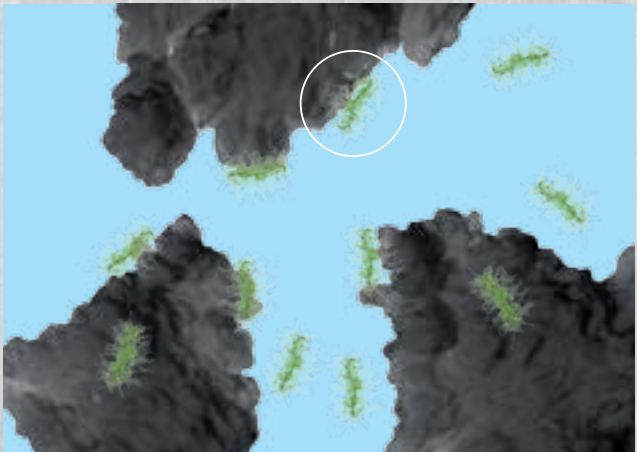
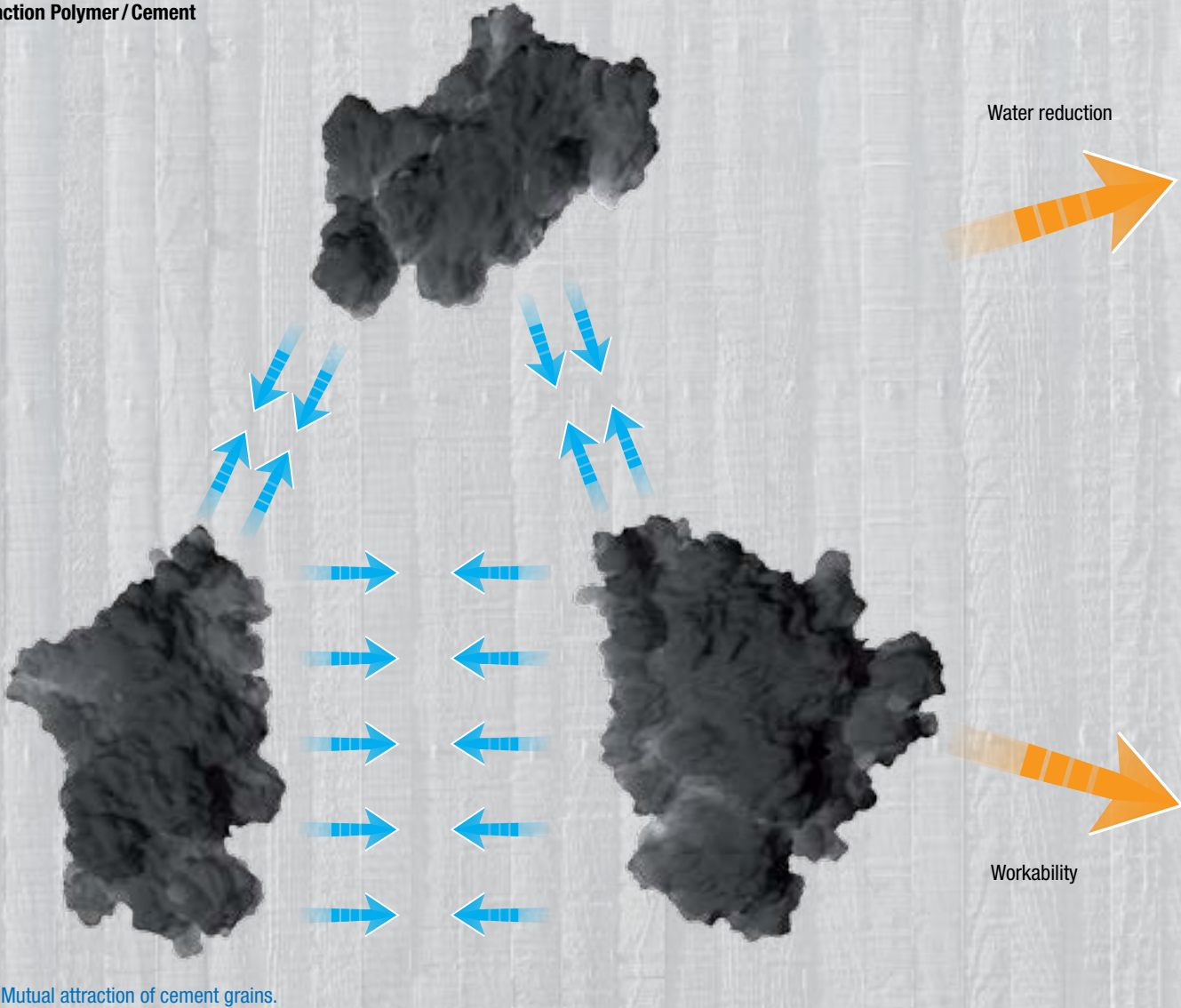
The polymers consist of backbones with carboxyl groups and side chains.

The first component – backbone with carboxyl groups – is responsible for the attainable water reduction/initial slump and mixing time respectively. The second one – side chains – determines the slump keeping capability of the superplasticiser, affected by an increasing number of side chains. The crucial factor is the limited space for carboxyl groups and side chains along the backbone. Either a carboxyl group or side chain can be attached at a certain location. This leads to the technological limitation that there are essentially three different types of polymers – water reducing, slump controlling and slump retention polymers.

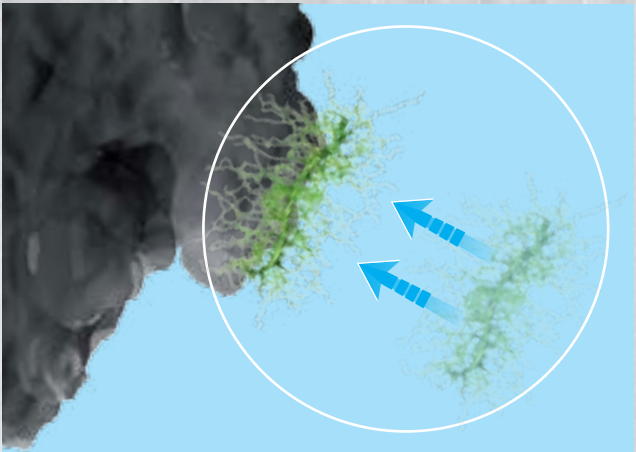
Polymer Structure PCE



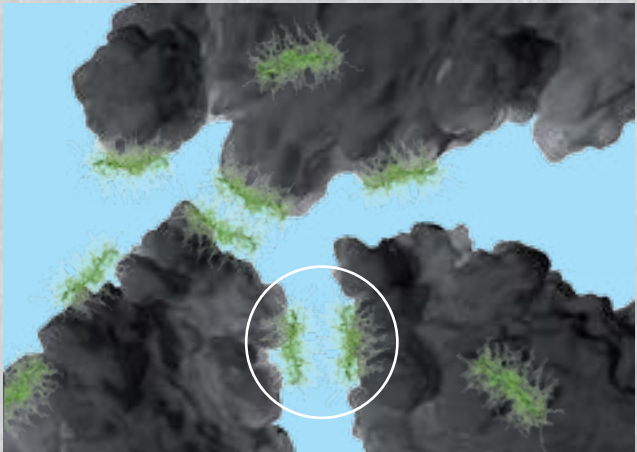
Interaction Polymer / Cement



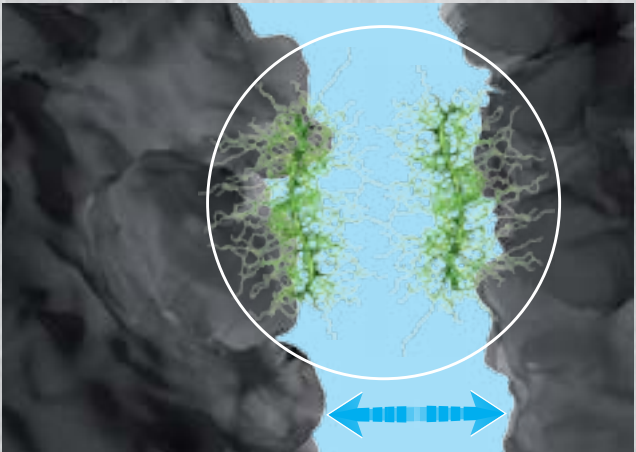
Adsorption of the polymer (backbone) on the cement grain.



Detail of the adsorption of the polymer (backbone) on the cement grain.



Improved workability due to steric hindrance.



Detail of improved workability due to steric hindrance.

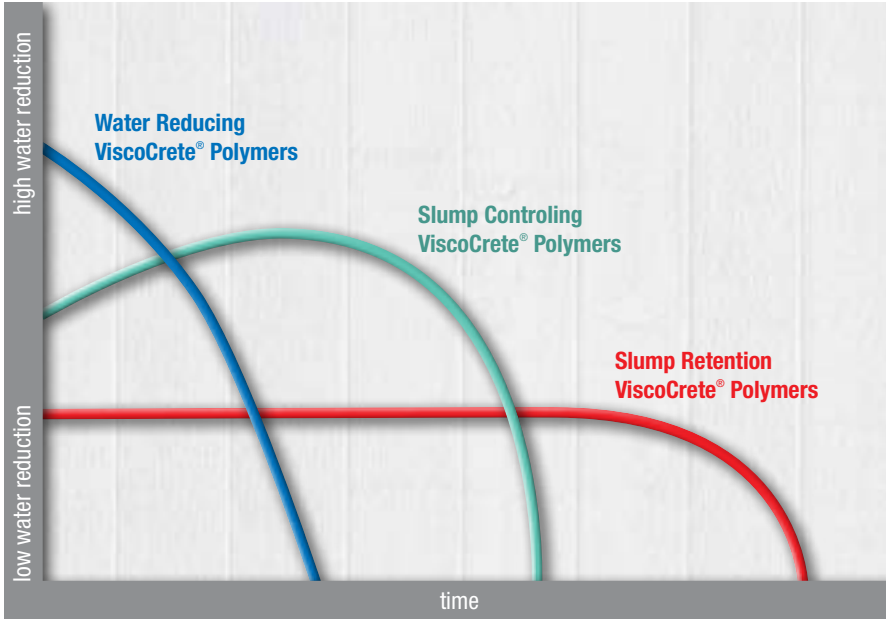


Sika® ViscoCrete® Product Technology

It is possible to design a PCE with a large number of carboxyl groups and consequently low number of side chains, leading to short mixing time with high water reduction and shorter slump life of the concrete-water reducing polymer.

Another possibility is to have a balanced ratio between carboxyl groups and side chains with an average/medium length. The result is a medium water reduction with subsequent adsorption resulting in a delayed dispersion effect. A polymer this way configured could be employed for slump controlling.

The third variation could be to have a large number of side chains resulting in lower water reduction and longer slump life. Moreover the adsorption speed of this polymer would be slow and a certain depot effect would result; an extended slump retention would be achieved with this polymer.



The **Sika® ViscoCrete®** technology offers more than the possibility to design PCE polymers with specific properties. It enables combination of various polymers to exploit the potential of each one. This compatibility is a major advantage of **Sika® ViscoCrete®** technology: tailor made solutions can be developed and adapted to the performance of the concrete mix. Moreover final products can be optimised with regard to local market requirements to yield the best cost-performance solution.



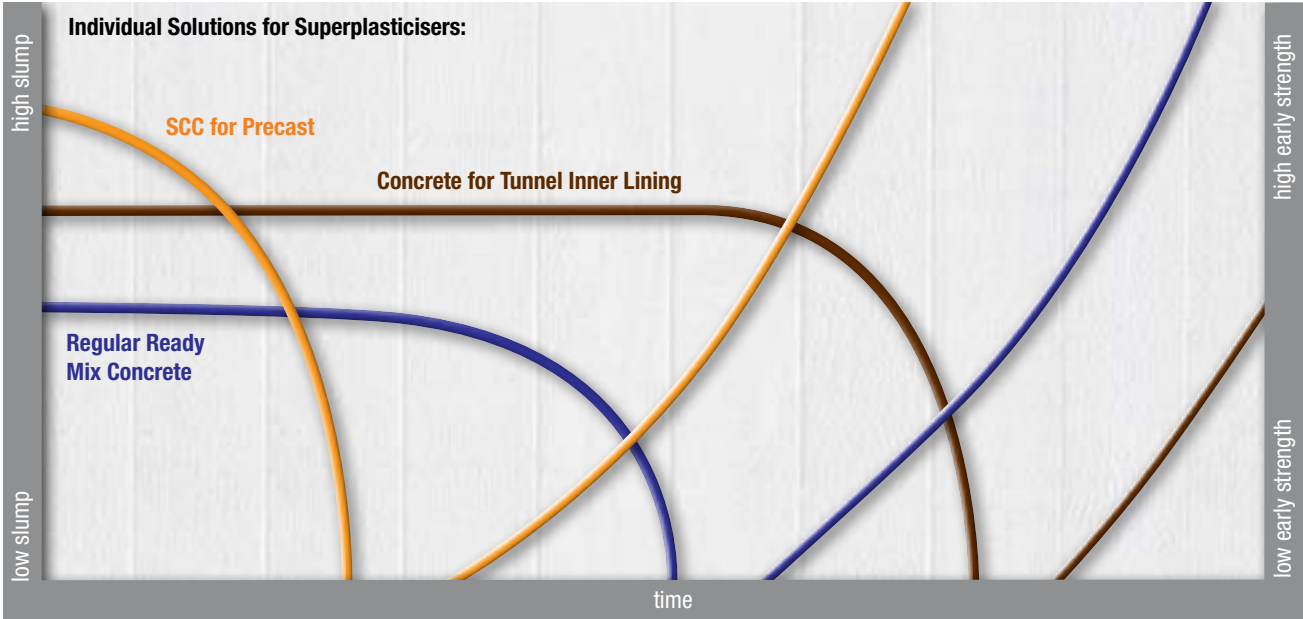
Key-Performance Drivers:

- Slump life
- Water reduction
- Early strength
- Workability

Raw Material Characteristics:

- Cement
- Aggregates
- Additives





Requirements and Applications

A highly flowable concrete helps simplify the entire construction process

Requirements

The specification of a certain compressive strength of the hardened concrete usually ensures the functionality of a standard. Durability and lifetime are increasingly important factors, on the other hand, are determined by minimum cement content and maximum water / cement ratio. These two factors, which influence strength and durability, are normally associated with a workability of fresh concrete sufficiently adjusted through application of a superplasticiser.

The speed of the whole construction process is gaining importance:

- Fast casting
- Fast discharge of mixer and truck
- Easy placing and compaction
- Good surface finish,
all of which result in overall reduced effort and time saving.

This factor leads to rising requirements regarding:

- Early strength development with sufficient slump life
- Fast stripping time with efficient formwork operation
- Cost control of material, energy, logistics and manpower.

Concrete with sufficient workability from batching plant to

compaction leads to higher quality, as there is no need for redosage of superplasticiser. The durability is increased as the probability of defects and blowholes is significantly reduced.

Sustainability of concrete structures does not only imply prolonging the durability of concrete and with this the service life of a construction. Moreover engineers involved in the design of concrete have to take into consideration the carbon footprint of the production of a concrete mix. The limitation of carbon dioxide emission for the production of concrete can be realised with the following measures:

- Optimisation of binder content
- Application of blended cement
- Usage of secondary cementitious material
- Increased application of filler
- Use of recycled aggregates

In order to produce concrete that is as resource-friendly as possible while fulfilling all technological requirements, it is necessary to make use of sophisticated superplasticiser technology.

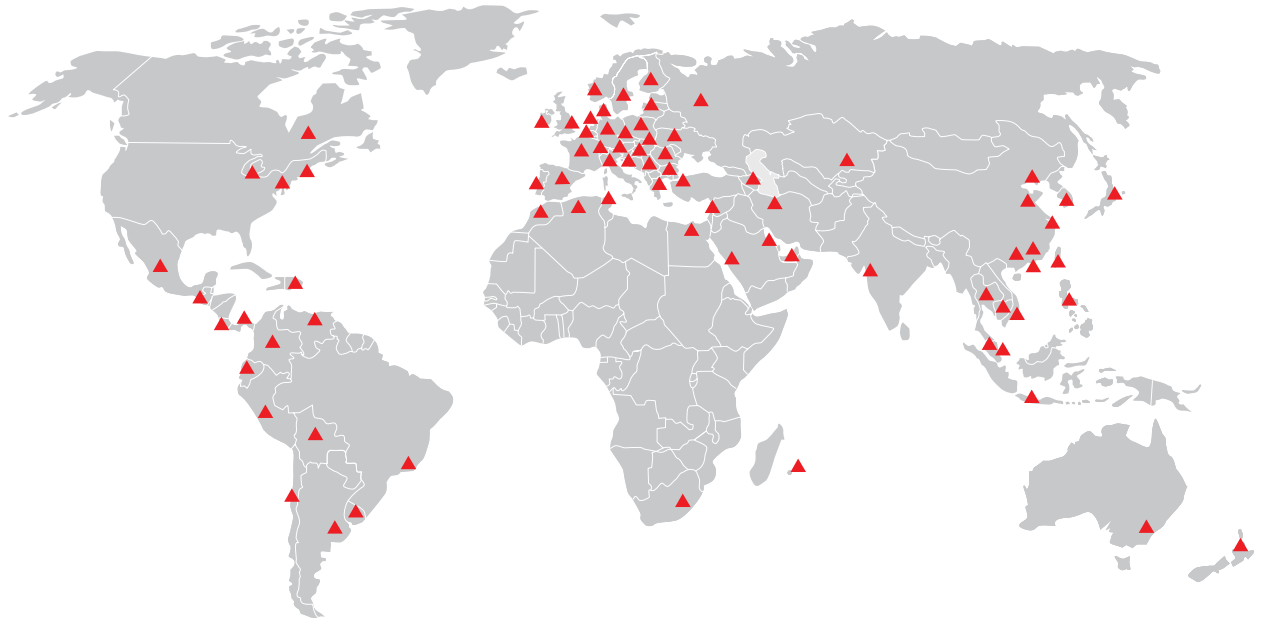
The use of **Sika® ViscoCrete®** as a high performance superplasticiser based on PCE technology is mandatory to target higher strength classes, fresh concrete with greater flowability, and sustainable concrete production.

Applications

The **Sika® ViscoCrete®** technology offers solutions for all application fields within the concrete industry – ready mixed concrete, precast concrete or site-batched concrete. **Sika® ViscoCrete®** achieves the ideal solution for your concrete challenge. Various construction process participants may have different requirements depending on their daily focus. **Sika® ViscoCrete®** adapts to these demands.



Sika Worldwide



Sika - Your Local Partner with a Global Presence

The information, and, in particular, the recommendations relating to the application and end use of Sika® products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users should always refer to the most recent issue of the Product Data Sheet for the product concerned, copies of which will be supplied on request.

Sika Limited

Head Office
Watchmead
Welwyn Garden City
Hertfordshire
AL7 1BQ

Tel: 01707 394444
Fax: 01707 329129
Email: sales@uk.sika.com
www.sika.co.uk

Sika Ireland Limited

Sika House
Ballymun Industrial Estate
Ballymun
Dublin 11
Ireland

Tel: +353 1 862 0709
Fax: +353 1 862 0707
Email: info@ie.sika.com
www.sika.ie



Certificate No. EMS 45308



Certificate No. FM 12504