

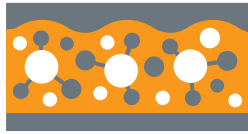


**Master X-Seed<sup>®</sup> STE**  
Strength-enhancing  
concrete admixture





## Master X-Seed STE at a glance



### Promote Cement Hydration

Based on a unique seeding technology to improve cement hydration, Master X-Seed STE provides the ability to reduce cementitious content of a concrete mixture, without decreasing the water cementitious materials ratio (w/cm).



### Strength Safety Factor

This strength-enhancing technology provides the flexibility to expand the performance space of a given concrete mixture and offers an increased strength safety factor.



### Reduce Environmental Impact

Reducing cementitious content in a concrete mixture helps to reduce the embodied energy of the mixture. This has the overall effect of reducing the energy demand and emissions associated with the production of portland cement.



### Durability

With the addition of Master X-Seed STE admixture, a concrete mixture can include higher levels of SCM, which improve the durability characteristics and support the overall life cycle of the concrete.



### Increase Production Efficiency

The strength enhancement provided by Master X-Seed STE admixture allows for earlier stripping and reuse of forms, thus increasing production efficiency and speed of construction in both precast and ready-mixed concrete applications.



### Strength Development

This unique solution increases both early and late-age strength development.



### Flexibility in Design

Increase strength development provides engineering and design flexibility.



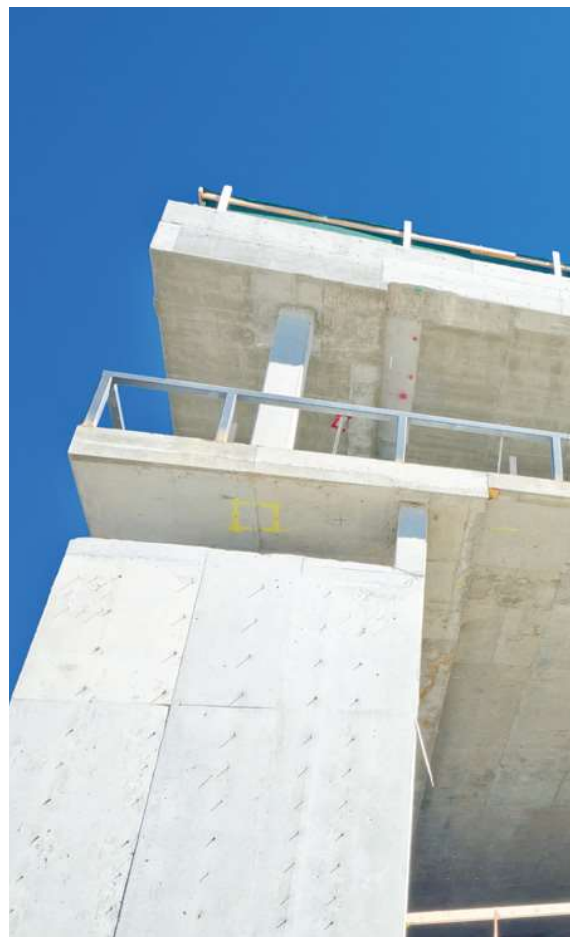
# Master X-Seed STE, Strength Redefined

An innovative strength enhancing admixture that significantly improves late-age strength development in concrete while supporting sustainable construction.

Master X-Seed STE admixture gives the option of either reducing the total cementitious materials (CM) content or increasing the replacement level of portland cement with a supplementary cementitious material (SCM), while maintaining or enhancing early and late-age strength development. This is most evident in an optimized sustainable concrete mixture, such as Master Builders Solutions' Green Sense® Concrete.

## Benefits of Master X-Seed STE Admixture

- » Seeding technology facilitates growth of CSH crystals and cement hydration
  - Provides a unique improvement in the hydration of portland cement
  
- » Increases strength development
  - Increases strength safety factor
  - Flexibility to expand the performance space of a concrete mixture
  - Permits earlier stripping of forms to improve production efficiency
  - Facilitates construction in cast-in-place concrete applications
  - Improves the strength consistency of a concrete mixture even when produced with variable raw materials
  
- » Facilitates optimization of the cementitious materials package of a concrete mixture
  - Increases replacement levels of supplementary cementitious materials
  - Promotes sustainable construction







# CSH Seeding Technology

Master Builders Solutions' X-Seed technology was introduced and has been utilized in strength enhancing applications since 2009. This patented technology to improve the quality of hardened cement paste was used to develop the Master X-Seed STE strength-enhancing admixture.

Master X-Seed STE admixture is a stable suspension of synthetically-produced crystalline calcium silicate hydrate (CSH) nanoparticles. These nanoparticles facilitate the growth of CSH crystals between cement grains and improve overall hydration of portland cement (Fig.1 and 2), thereby increasing early and late age strength development.

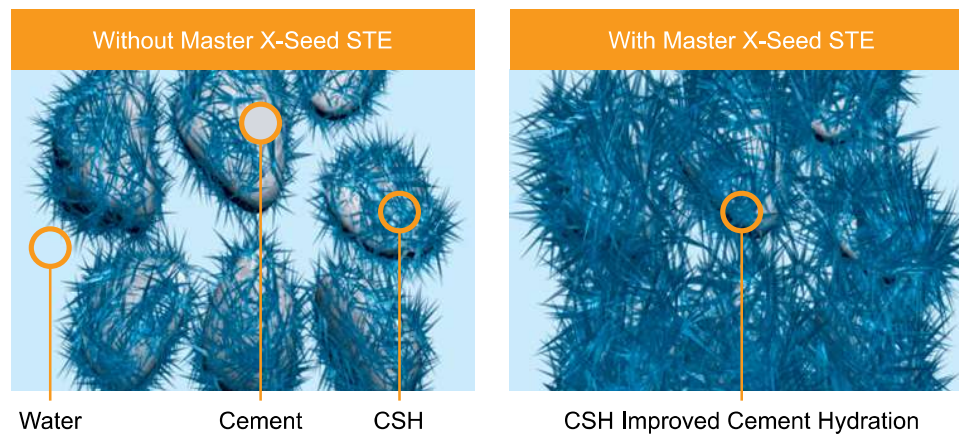


Figure 1  
Illustration shows increased CSH crystal growth with Master X-Seed STE admixture

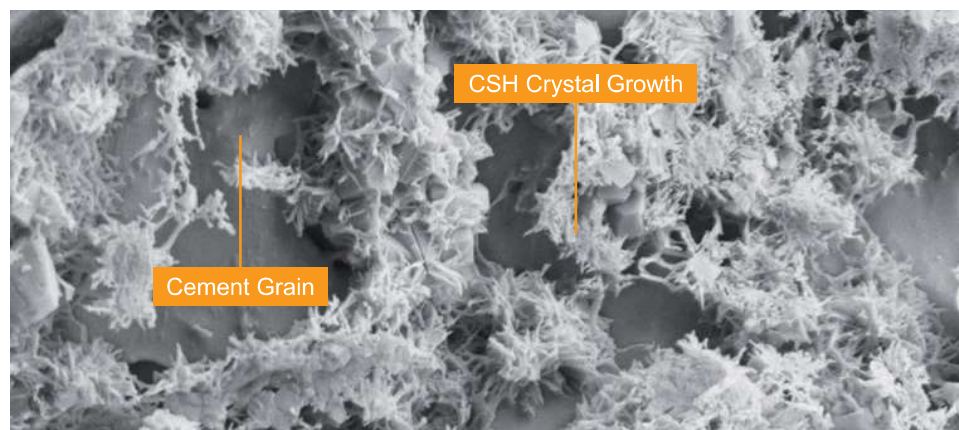


Figure 2  
Image from CryoSEM with portland cement paste treated with Master X-Seed STE admixture shows active crystal growth between the cement grains



# Performance Results

## Enhancement in Compressive Strength

The chart (Fig. 3) below shows the strength enhancement that can be achieved in a concrete mixture containing Master X-Seed STE admixture compared to a reference untreated mixture.

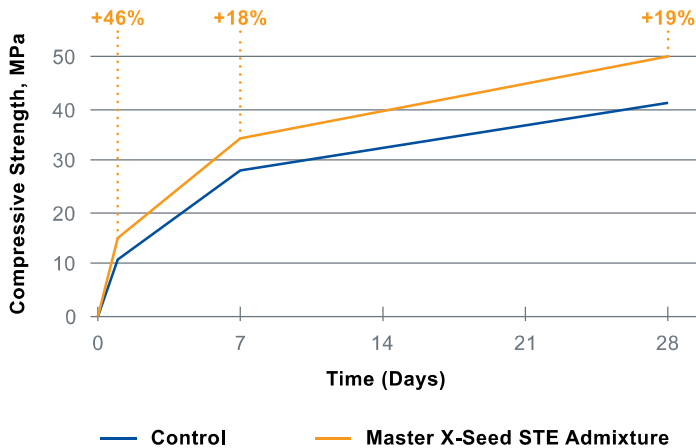


Figure 3  
Enhancement in compressive strength from addition of Master X-Seed STE admixture

Nominal cementitious materials content of 360 kg/m<sup>3</sup> with 20 percent fly ash, w/cm of 0.47; Master X-Seed STE admixture dosage of 650 mL/100kg

## Reduced Cementitious Content

The chart (Fig. 4) below shows the effect of Master X-Seed STE admixture on the compressive strength of concrete that can be achieved with reduced cementitious content compared to a reference untreated concrete mixture.

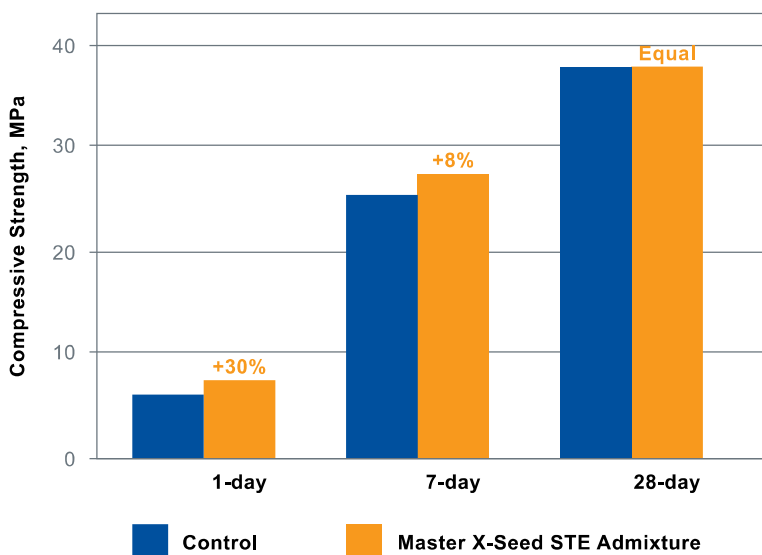


Figure 4  
Potential for reducing cementitious materials (CM) content with Master X-Seed STE admixture – mixture's CM content reduced by 45 kg/m<sup>3</sup>

Control: Total binder content - 420 kg/m<sup>3</sup> with 25 percent fly ash, 21 percent limestone powder, w/cm of 0.39; Master X-Seed STE admixture: Dosage of 475 mL/100kg, Total binder content - 375 kg/m<sup>3</sup> with 25 percent fly ash, 21 percent limestone powder, w/cm of 0.40



# Master Builders Solutions for the Construction Industry

**MasterAir®**

Complete solutions for air entrained concrete

**MasterBrace®**

Solutions for concrete strengthening

**MasterCast®**

Solutions for hyper-plasticized concrete

**MasterCell®**

Density reducing admixtures

**MasterCem®**

Solutions for cement manufacture

**MasterEase®**

Solutions for low viscosity concrete

**MasterEmaco®**

Solutions for concrete repair

**MasterFinish®**

Solutions for formwork treatment

**MasterFlow®**

Solutions for precision grouting

**MasterGlenium®**

Hyperplasticizer formulated from state-of-art polymers for ultimate performance

**MasterInject®**

Solutions for concrete injection

**MasterKure®**

Solutions for concrete curing

**MasterLife®**

Solutions for enhanced durability

**MasterMatrix®**

Advanced rheology control solutions for self-consolidating concrete

**MasterPel®**

Solutions for water tight concrete

**MasterPolyheed®**

Solutions for high performance concrete

**MasterPozzolith®**

Solutions for water-reduced concrete

**MasterProtect®**

Solutions for concrete protection

**MasterRheobuild®**

Solutions for super plasticized concrete

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Solutions for underground construction

**MasterSeal®**

Solutions for waterproofing and sealing

**MasterSet®**

Solutions for retardation control

**MasterSuna®**

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