

MASTER[®]
» BUILDERS
SOLUTIONS



— Master X-Seed[®]

**Advanced Accelerator
Solutions for Concrete**

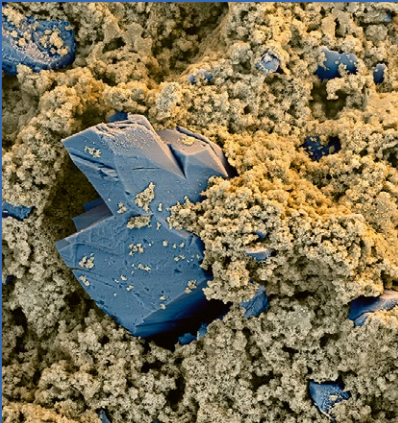
Master X-Seed®

A Unique Accelerator Technology

At a glance

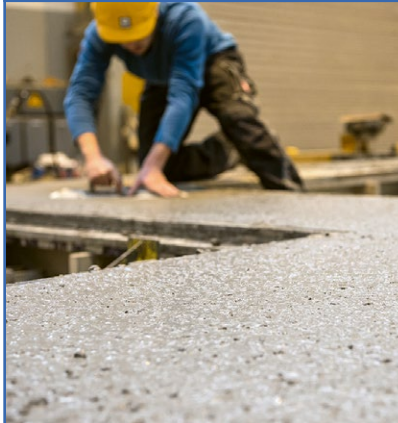
- Master X-Seed® is a unique concrete hardening accelerator that supports sustainable construction.
- With Master X-Seed®, the concrete industry can realize cost savings and improve commercial success.
- Master X-Seed® is based on a unique seeding technology which allows unrivaled high early strength development at low ambient and heat curing temperatures.
- Unlike than conventional accelerators, Master X-Seed® has no detrimental effect on concrete rheology; even highly flowable mixes with extended workability retention can achieve excellent early strength.
- Hardening acceleration through Master X-Seed® adds value by allowing various options for mix design optimization, flexibility of construction, curing conditions and process speed.

Seeding



- Unique technology
- Patent protected
- Barrier-free growth
- Suitable for all strength classes

Process



- Flexible capacities
- Higher output with no additional investment in equipment
- Fast, efficient production
- Cost reduction
- Predictable hardening properties
- Fast and reliable project progress
- Excellent rheology and workability retention
- Reliable concreting in winter conditions

Benefits



- More sustainable concrete production
- Energy reduction
- Material optimization
- High performance specifications
- Not affected by cold weather
- Predictable high early strength
- Reduced waiting times
- Higher return on production assets
- High-quality concrete surface
- Early drying of concrete and reduced waiting times

Solution for Sustainable Concrete Production

Energy efficiency and material optimization

Traditional acceleration methods such as heat application or common nitrate-based accelerators typically affect the durability and final strength of concrete. The use of Master X-Seed® supports and accelerates the natural cement hydration process. This solution enhances long-term performance properties at the same time as offering attractive overall cost saving potential.

With Master X-Seed®, the concrete industry can achieve better process economy, higher concrete quality and increased energy efficiency, saving money and reducing CO₂ emissions. Master X-Seed® consists of synthetically produced particles suspended in a stable liquid. It boosts the hardening properties of the concrete mix.

Master X-Seed® makes concrete production more sustainable. A hardening boost that was previously impossible is obtained at all temperature levels in the early stages (6–12 hrs). The improved hardening process induced by seeding also enhances the final performance of the concrete.

The treatment of concrete with Master X-Seed® promotes and improves strength development. This is in line with key industry needs like speed of construction, flexibility and overall cost savings. It is fully compatible with Master Builders Solutions® admixture technologies, such as MasterCO₂re™, MasterEase®, MasterPolyheed®, MasterGlenium® and MasterMatrix®.



Our reference in
Bramsche, (Germany):
Precast concrete elements



Accelerated Benefits:

Reduced Costs, Energy-Efficient, Sustainable

Accelerated benefit – Flexible process:

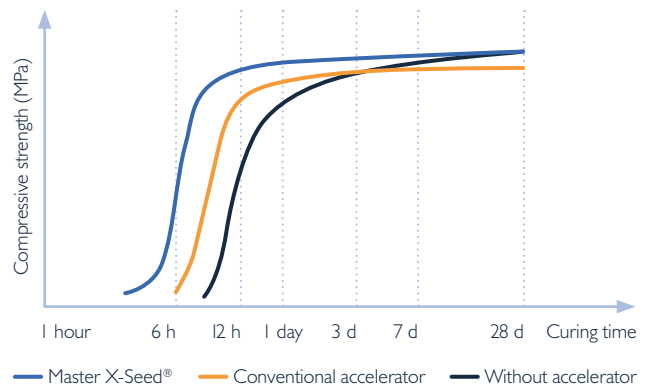
The essential performance benefit of Master X-Seed® is fast strength development in the early stages of hydration at low ambient and heat curing temperatures. This increases productivity and has a direct impact on cost efficiency. The flexibility to increase capacity quickly without investment in assets is especially useful for responding to product demand peaks at precast plants. With Master X-Seed®, no additional installations are needed for reaching higher output targets. In addition, at times of low demand, the optimization of production assets is essential. Master X-Seed® offers faster processes and increased production output within the normal production configuration. Double rotation can help with tailored formwork use, facilitating work with fewer forms or using existing forms more frequently.

Accelerated benefit – Energy reduction:

Heat curing is an energy and cost-intensive method of achieving a higher early strength development. It is mainly used during winter periods or when more production cycles are required to satisfy high market demand. However, the application of direct or indirect heat to the concrete has to be effectively controlled in order to minimize durability risks (internal stresses, delayed ettringite formation). With Master X-Seed®, you can reduce or even eliminate the need for the heat curing of concrete, thus saving the installation cost of heat curing equipment as well as reducing the need for expensive rebars to counteract thermal stress during heat curing. Not only do both effects help reduce the CO₂-footprint of production – they also ensure direct cost savings in production.

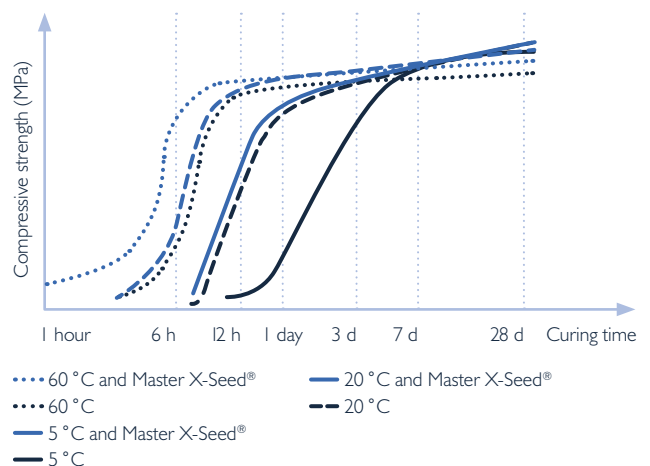
Strength development – Accelerator effect

(fluid concrete with 380 kg/m³ CEM I 52.5 R)



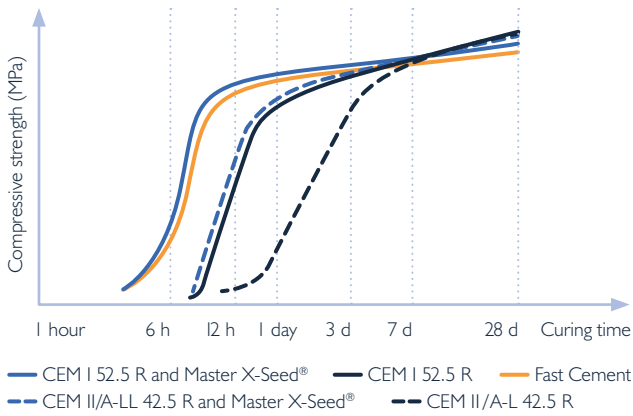
Strength development – Temperature effect

(fluid concrete with 380 kg/m³ CEM I 52.5 R)



Strength development – Cement effect

(fluid concrete with 380 kg/m³ CEM I 52.5 R)



Accelerated benefit – Material optimization:

Low-clinker cements and the use of Supplementary Cementitious Materials (SCMs) are important tools for optimizing mix designs in order to achieve specific performance requirements and improve sustainability. However, this typically comes at the expense of early strength development and needs to be compensated by higher amounts of binder material especially in precast operations. Master X-Seed® allows dedicated binder optimization without losing early strength behaviour or changing the performance properties of fresh concrete.

This has a quantifiable, positive impact on final strength and contributes to lower CO₂ plant emissions. At the same time, optimized mix designs often reduce overall cost.



Our reference in Frankfurt, (Germany): Construction of the Marienturm



Fields of Application

Master X-Seed® in precast


High early strength development is of key importance for precast concrete producers. In a capital-intensive industrialized production process with stringent quality control, the critical economic factors are fast re-utilization of formwork and a continuously high, flexible output at the lowest possible cost. The need for fast strength development makes the best-suited mix design an essential prerequisite – this is guaranteed with Master X-Seed®. Key benefits for precast production are earlier demolding, shorter cycle times and therefore more efficient utilization of expensive molds, flexible adjustment of plant capacity, reduction or elimination of costly, energy-intensive steam curing and the ability to utilize multiple grades of cement. By combining and balancing these benefits, the overall output of a plant can be boosted at the same time as allowing cost reductions.

Master X-Seed® for high-speed construction and repair

Construction project schedules face a number of challenges including weather conditions, unforeseen problems on site and simply a very tight timeline. Master X-Seed® offers the possibility of working faster and, allows faster turnover on the jobsite and reduced drying time for concrete. The overall concrete work can be completed faster and more easily: Formwork can be removed earlier, expanders and steel props can be fixed earlier in recently cast concrete and the overall building process can be accelerated. On repair projects, concrete producers can combine Master X-Seed® with cement used for their conventional bulk concrete. These mixes can match or exceed the performance of specialized fast cements. The key benefit of using Master X-Seed® in time-critical jobs is its unmatched ability to speed up the concrete hardening and drying process. Whatever challenge a construction schedule may pose, Master X-Seed® is a valuable tool for speeding up the process.

Challenges for winter projects

In the winter, projects often have to be delayed or even cancelled due to adverse weather conditions. With Master X-Seed®, concrete producers and users can be flexible and adapt to the needs of winter concreting. The essential requirement in winter concrete production is adequate early strength gain. The protection of the fresh concrete against freezing is even more important. The time before initial setting of concrete is most crucial in this respect.



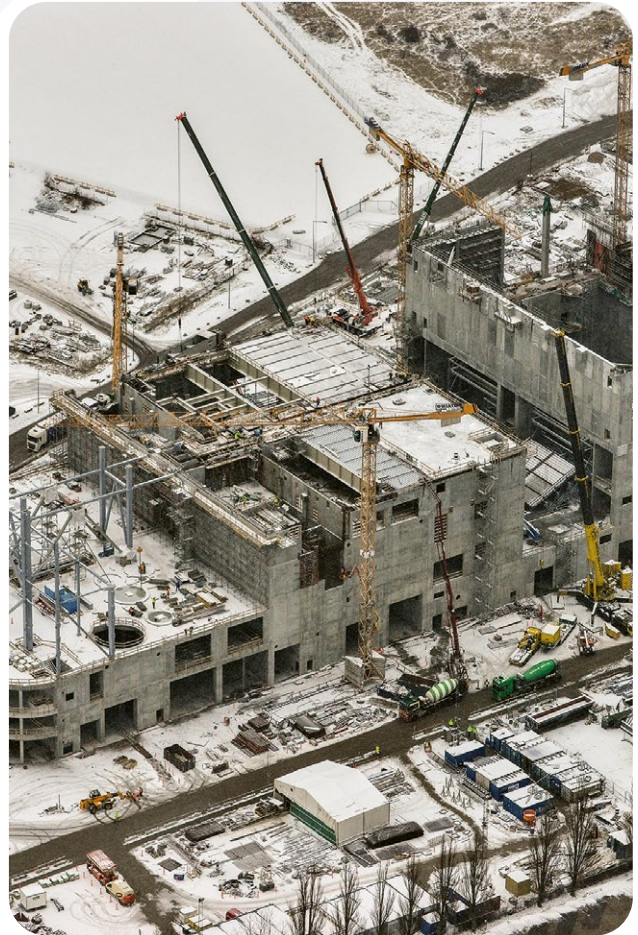
With Master X-Seed®, concrete producers can adapt to the needs of winter concreting.

Additional cost and impaired rheological properties

To prevent freezing, energy-intensive and costly measures such as the preheating of aggregates and mixing water and the use of heating blankets and accelerators are employed. Conventional accelerators and freeze protection agents result in poorer workability control and impair the rheological properties of fresh concrete. The final strength of the concrete may be affected and its use may be limited in some markets as a result of durability considerations. The use of conventional accelerators is also problematic as the start of the acceleration effect varies considerably with temperature and dosage. As a result, the concrete has to be monitored very closely to ensure proper setting and avoid freezing damage.

Master X-Seed® for winter projects

Master X-Seed® avoids all the detrimental effects of conventional accelerators described above. Winter concrete treated with an appropriate combination of Master X-Seed® and MasterCO₂re™, MasterEase® or MasterGlenium® water reducer reaches the same workability levels, the same workability retention and the same outstanding rheological properties as concrete under conventional conditions. Master X-Seed® accelerates the hardening process and makes it very predictable. Once hardening starts, the accelerated heat development due to cement hydration ensures adequate concrete core temperatures. Hardening processes proceed as normal even at freezing temperatures. Finally, the winter concrete reaches the same or better mechanical properties as non-accelerated concrete under standard conditions.



Master X-Seed® facilitated the construction of the Amager Bakke waste-to-energy plant in Copenhagen, Denmark. The plant includes a roof-wide artificial ski slope open to the public.

Your benefits

With Master X-Seed® progress with a construction project becomes largely independent of weather conditions and projects can be completed reliably and predictably even in the winter. The key benefits of using Master X-Seed® in winter concrete are reliable acceleration, excellent control of rheology in all workability levels, flexible use under adverse weather conditions and increased speed of construction in all seasons.

- Faster concrete work
- Faster turnover on the jobsite
- Predictable process
- Reduced drying time also in winter

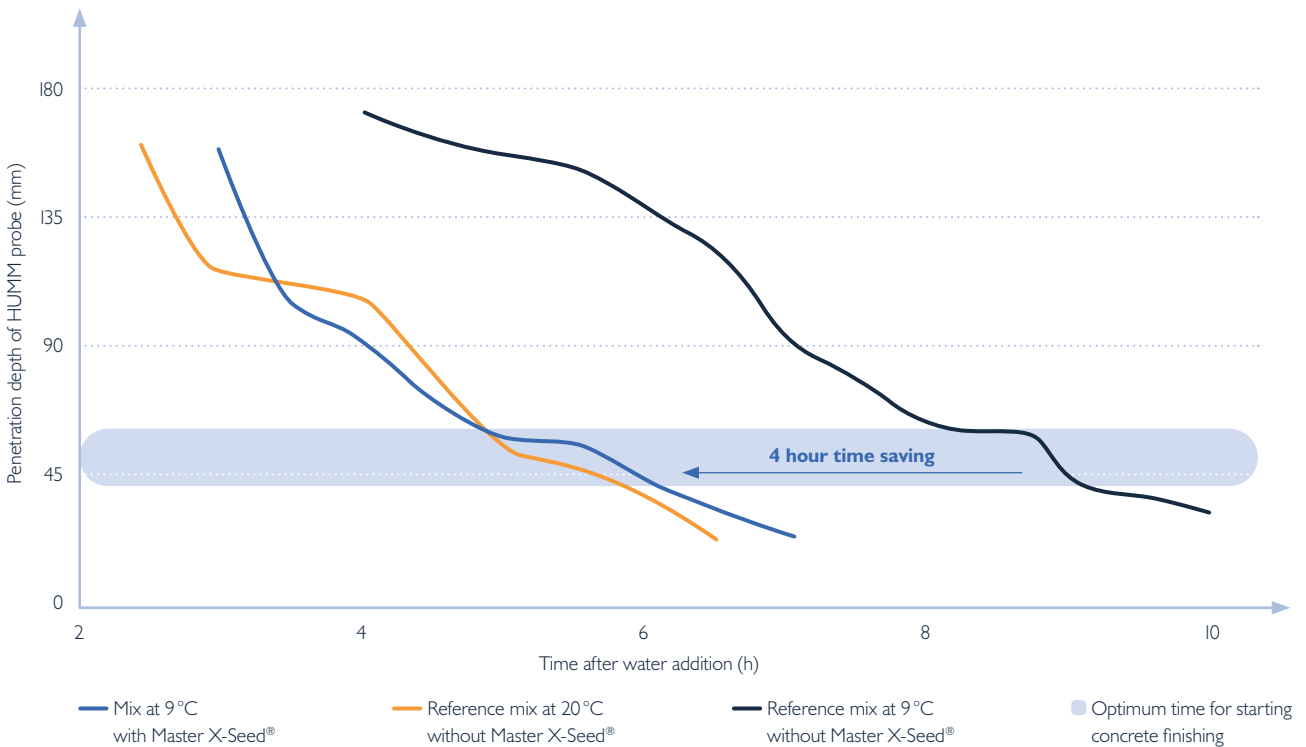


Master X-Seed® for concrete flooring projects

In flooring, especially under cold weather conditions, delayed setting and strength development can lead to additional costs as finishing may be delayed. Workers therefore have to spend more time on the construction site waiting for the troweling to start. Master X-Seed® makes the troweling time more predictable and independent from weather conditions. Finishing can start earlier and the project can be finished in a shorter time. The concrete solidifies evenly over the entire cross-section and achieves ideal durability.

A reliable tool for determining the right time to start trowelling is the HUMM probe. When the probe has been tapped into the concrete 25 times, the penetration depth shows when troweling is possible: When it penetrates less than 4–6 cm, the process can start. With Master X-Seed®, this may be up to 4 hours earlier than with conventional concrete.

The HUMM probe reliably determines the optimum time for starting concrete finishing.



Mode of Action

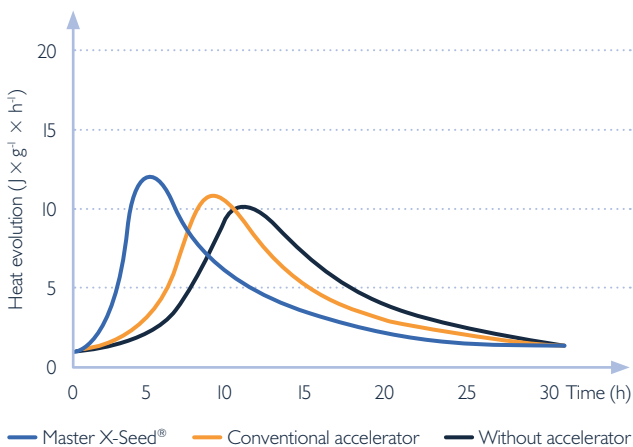
Cement hardening

In cement hydration, the clinker reacts with water in a dissolution/recrystallization pattern to form Calcium Silicate Hydrate (CSH) crystals. The recrystallization of the CSH crystals is exothermic: Initial hardening can be monitored by heat flow measurements.

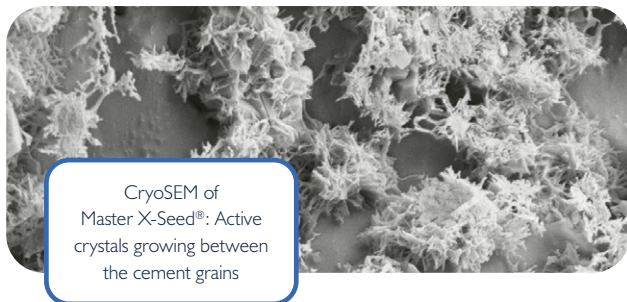
Without the addition of an accelerator, the hydration process only starts after a certain dormant period, which is strongly dependent on the concrete temperature. Furthermore, once recrystallization occurs, the developing CSH crystals grow on the cement grain surface. This hinders and further slows down the reaction of the remaining clinker.

Heat evolution – Accelerator effect

(380 kg/m³ CEM I 52.5 R)

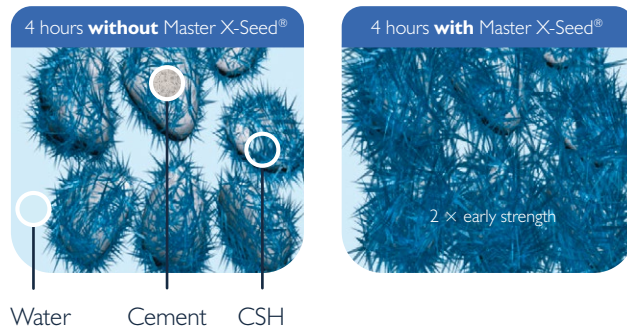


— Master X-Seed® — Conventional accelerator — Without accelerator



Crystal seeding

Adding Master X-Seed® changes the picture dramatically. Master X-Seed® consists of a suspension of very fine, synthetically produced CSH crystals in a ready-to-use, stable admixture suspension. These CSH crystals offer a very large active surface for the growth of hydration products during concrete hardening. They act as crystal seeds. With these active CSH crystals in the concrete, hydration can virtually start without any delay, and the dormant period is significantly reduced and much less temperature-dependent. Since the hydration products grow on the surface of the CSH seeds, the surface of remaining clinker stays free of nucleation products. The growth of the crystal structure is much faster. Earlier hardening as well as higher earlier strength are observed. Unlike conventional accelerators, it has been shown that Master X-Seed® does not promote the corrosion of steel reinforcement. Also Master X-Seed® does not impair final strength as is the case with heat treatment and other acceleration technologies.



Schematic view of CSH crystals in cement and water pore solution

Temperature-independent technology

Like any chemical reaction, cement hydration slows down with lower temperatures and speeds up at higher temperature. The unique Master X-Seed® technology provides unmatched acceleration of the hydration process in the early stages, irrespective of temperature. Unlike conventional technologies, Master X-Seed® is active at all temperatures, for example in winter, summer and under steam curing conditions.





Master Builders Solutions®

As Master Builders Solutions®, we are a leading global producer of responsible solutions for the construction industry, focussed on delivering our vision: **Inspiring people to build better.**

We provide value-added technology and market-leading R&D capabilities to improve the performance of construction materials and to enable the reduction of CO₂ emissions in the production of concrete. The comprehensive portfolio under the Master Builders Solutions® brand encompasses concrete admixtures, cement additives, and solutions for underground construction.

We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects worldwide, leveraging global technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction.

Founded in 1909, Master Builders Solutions® operates 35 production sites globally, supporting you in mastering your building challenges of today and tomorrow – for a decarbonised future.



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

MasterCO₂re™

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

MasterMatrix®

Advanced rheology control for concrete

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 MasterCO₂re™: Intelligent Cluster System for Low-clinker Concrete Production

info.master-builders-solutions.com/en/masterco2re



Master Builders Solutions UK Ltd

Swinton Hall Road, Swinton,
Manchester, M27 4EU
T +44 161 727 6300

ukinfo@masterbuilders.com

www.master-builders-solutions.com

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