



**MasterLife Solutions for
durable concrete**



Master Builders Solutions

Master Builders Solutions brand is built on over a century of experience in the construction industry.

We combine the right elements from our portfolio to solve your specific construction challenges. We leverage global Master Builders Solutions 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.

Our comprehensive portfolio

- Concrete admixtures
- Cement additives
- Chemical solutions for underground construction
- Waterproofing solutions
- Sealants
- Tile fixing systems
- Concrete repair and protection solutions
- Performance grouts
- Performance flooring solutions
- Wall systems
- Fire protection systems

Cover page project reference: Hoover Dam, 1935, Master Builders Solutions Admixtures





Solutions for Concrete Durability Issues

Durability and service life are major considerations in the design of concrete structures subject to aggressive environments. Typical projects requiring long-term durability include dams, bridges, parking garages, water and wastewater treatment facilities, marine and various other structures. Designing more durable, longer-lasting concrete structures is a constant goal of engineers, architects, owners, government agencies, contractors and concrete producers worldwide.

The durability of concrete is affected by many issues including:

- Corrosion
- Sulfate Attack
- Alkali-Silica Reaction
- Microbial-Induced Corrosion
- Cracking
- Strength
- Permeability

Corrosion

Chloride ions enter concrete from deicing salts on roads and bridges or from seawater in marine environments. Other sources of chloride ions include admixtures made with intentionally-added chlorides, chloride-contaminated aggregates and/or mixing water and salts in ground water. Chloride ions promote corrosion of reinforcing steel and other metals in concrete, which then expand and cause the surrounding concrete to crack and deteriorate.

The MasterLife® CI family of corrosion-inhibiting admixtures offers options to delay the onset and reduce the rate of corrosion of steel reinforced concrete structures.

MasterLife CI 222 admixture

- Organic-based amine-ester corrosion inhibitor
- Reduces concrete permeability
- Forms a protective film at the steel surface

MasterLife CI 30 admixture

- 30% calcium nitrite
- Inorganic anodic-type corrosion inhibitor
- Reacts with ferrous ions to form an oxide film at the steel surface

Further durability enhancement against corrosion is attainable by combining MasterLife CI series of corrosion inhibitors with the use of MasterLife SF 100 silica fume. MasterLife SF 100 silica fume reduces concrete permeability by providing additional hydration products that reduce the number and size of capillary pores. This makes it even more difficult for chloride ions to penetrate concrete to the surface of the reinforcing steel.

Sulfate Attack

Soil, groundwater, or water bodies containing sulfates can be detrimental to concrete. The chemical reactions cause deleterious expansive forces within the concrete matrix, resulting in cracking and deterioration. MasterLife SF 100 silica fume increases the resistance of concrete to sulfate attack by reducing its permeability. MasterLife CI 222 admixture also works to increase sulfate resistance due to its permeability-reducing mechanism.

Alkali-Silica Reaction (ASR)

Concrete containing certain reactive siliceous aggregates may experience abnormal internal expansion and cracking due to alkali-silica reaction.

MasterLife SF 100 silica fume, may also be used in concrete to combat ASR. The use of this pozzolan reduces both concrete permeability and the alkalis that react with the silica in the reactive aggregates.

Microbial-Induced Corrosion (MIC)

In applications where concrete is exposed to sewage or wastewater, activity by micro-organisms can lead to bio-deterioration of concrete through a process known as microbial-induced corrosion. Consequently, unless protective measures are taken, MIC will cause premature deterioration in concrete pipes, manholes and other structures that carry sewage or wastewater, resulting in increased maintenance and life-cycle costs.

Master Builders Solutions' MasterLife AMA 100 admixture is an EPA-registered liquid integral concrete admixture for the prevention of microbial-induced corrosion. Based on a novel organosilane chemistry, MasterLife AMA 100 admixture molecularly bonds to cement hydration products and ruptures the cell membrane of harmful bacteria and other micro-organisms on contact through an electro-physical mechanism. This creates a concrete surface that is not conducive to the growth of harmful micro-organisms.

Cracking

Cracking of concrete is a major concern. Cracking may be due to plastic shrinkage and plastic settlement of concrete in the unhardened state or to drying shrinkage or other factors in the hardened concrete. Cracking due to plastic shrinkage and plastic settlement can be minimized by adding Master Builders Solutions' MasterFiber® synthetic fibers to the concrete. Because the fibers are uniformly distributed throughout the concrete mixture, they control bleeding, keep the heavier constituents of the mixture in place, and inhibit cracks.

Depending on the application rate, fibers can inhibit up to 80-100% of plastic shrinkage cracking.

Master Builders Solutions' MasterLife SRA series of shrinkage-reducing admixtures and MasterLife CRA 007 crack-reducing admixture can be used to reduce drying shrinkage and the potential for subsequent cracking in concrete. These admixtures function by reducing capillary tension of pore water, thereby reducing the internal stresses that cause concrete to shrink.

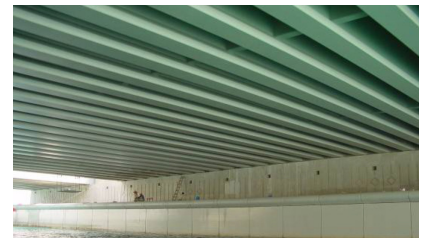
Reducing drying shrinkage lowers the potential for cracking, thus improving aesthetics, watertightness and durability. Drying shrinkage may be reduced by as much as 80% at 28 days and up to 50% at one year depending on the concrete mixture and the dosage of the admixture used. A secondary benefit of reduced drying shrinkage is reduced curling in slabs-on-ground.

Strength

For many concrete structures, strength is an important property that affects production, quality, and durability. Supplementary cementitious materials are often essential to the production of high-strength concrete. MasterLife SF 100 silica fume is a micro-filling material that physically and chemically fills the voids between cement particles thereby increasing concrete strength at all ages.

The use of Master Builders Solutions' MasterGlenium®, MasterEase® and MasterPolyheed® families of high-range water-reducing admixtures in combination with MasterLife SF 100 silica fume will further increase strength, by facilitating the production of concrete mixtures with very low water-cementitious materials ratios.

Project reference: Abu Dhabi Corniche - MasterLife CI 222





Watertight Concrete

Waterproofing Concrete

Many of the deleterious reactions described in this brochure require the presence of water. Water can pass through untreated concrete due to the mechanisms of capillary absorption and hydrostatic pressure. The MasterLife WP range of admixtures offers solutions for every need:

- MasterLife WP 707 Cost-effective solution for non-critical areas
- MasterLife WP 730 High-performance hydrophobic pore-blocking admixture
- MasterLife WP 740 Hydrophobic pore-blocking admixture in powder form
- MasterLife WP 1200 Liquid admixture utilizing crystalline technology
- MasterLife WP 3760 Admixture in powder form utilizing crystalline technology

Areas of use include water treatment infrastructure such as sewage treatment plants, water reservoirs, tanks for potable water, dams, bridges, culverts, chemical factories, food processing facilities and anywhere concrete is exposed to wet, harsh and aggressive environments.

The MasterLife WP range can also be used in foundations, basements, lift pits, podium decks, terraces, balconies, rooftops, facades, water and liquid retaining structures, substations, parking structures, precast concrete, tunnels, and subway systems.

Master Builders Solutions can provide a full package of products for any structure where there may be a risk of water ingress. These products include waterbars, swellable gaskets, re-injectable hoses and protective coatings.

Project reference: Riyadh Metro - MasterLife CI 222



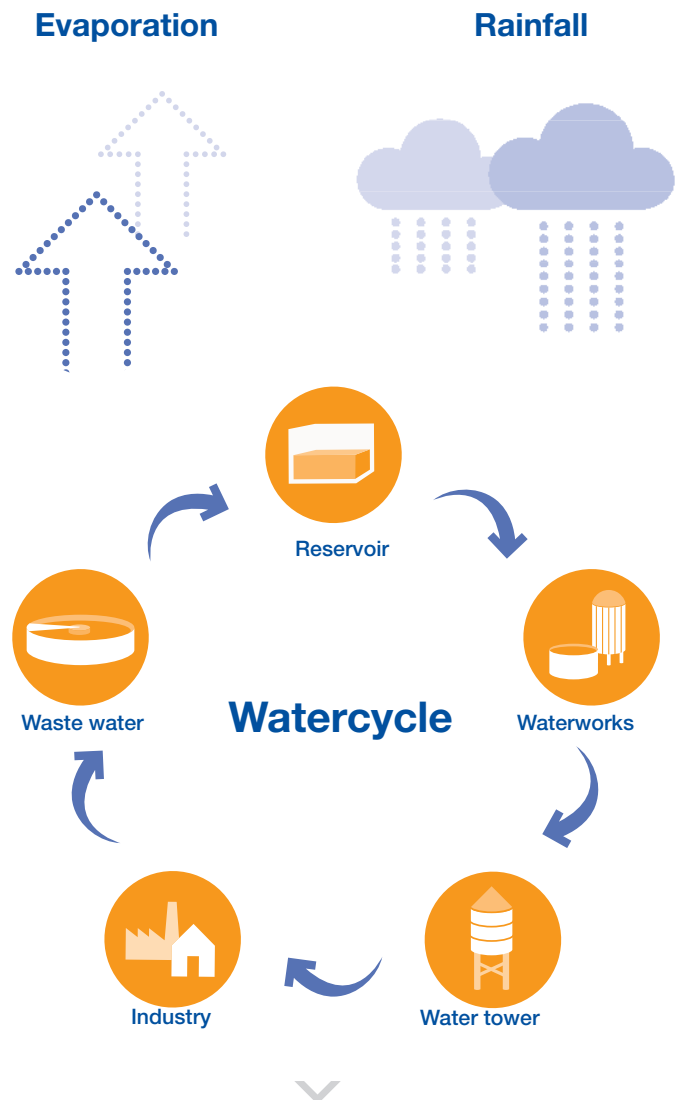
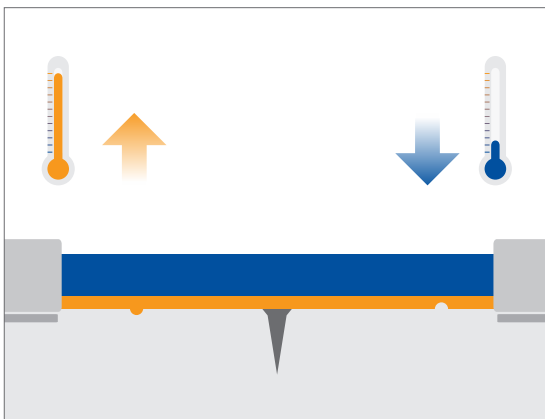


A Major Challenge: Waterproofing along the Water Cycle

Concrete structures along the water cycle are in permanent contact with water and need to remain operational without interruptions.

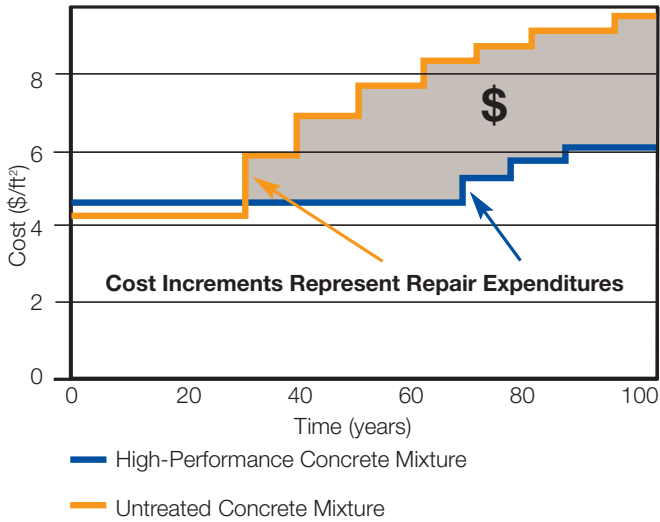
Waterproofing is a major challenge.

Water can penetrate building materials by various means, such as capillary absorption, ponding, hygroscopic uptake or condensation. The effective waterproofing of dams, channels, aqueducts, water tanks, water towers, waste water plants or other building structures, to prevent water ingress or loss, is a major challenge requiring easy application, a quick return to service and long-term durability.



Economic Benefit

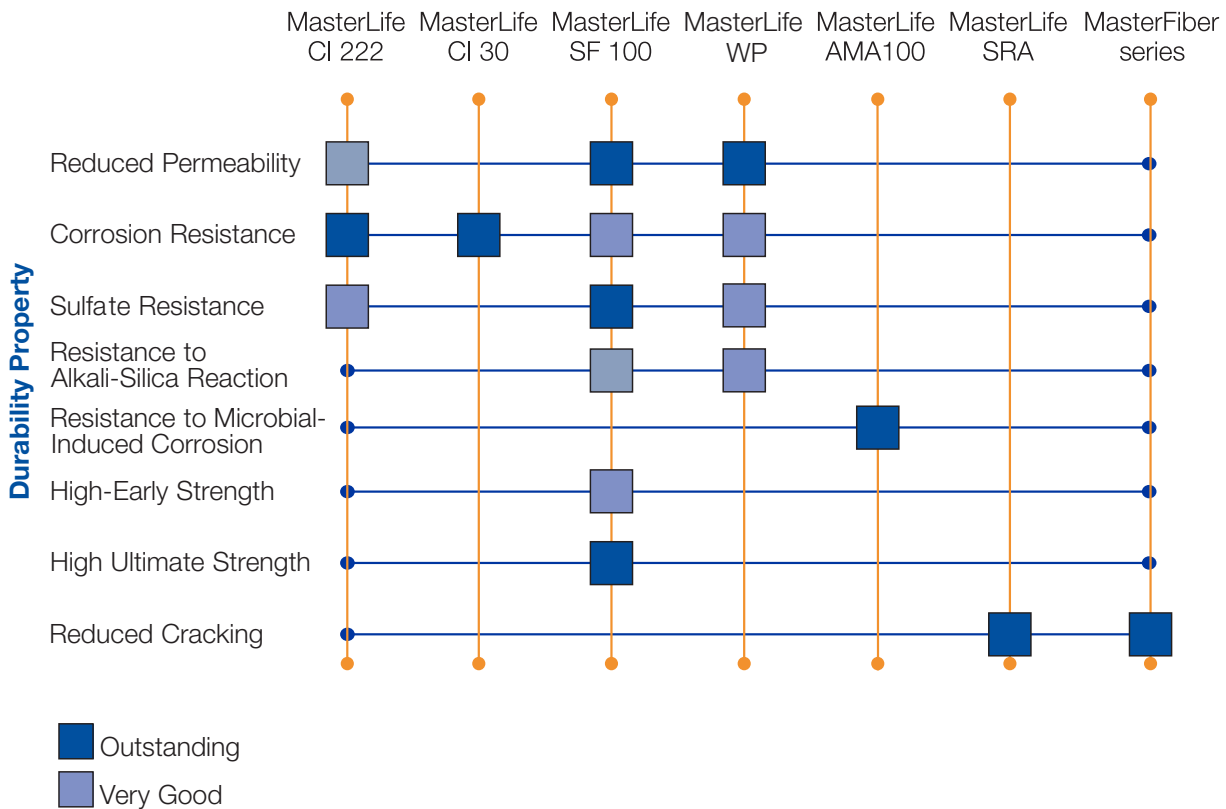
Concrete designed for durability will typically increase the initial cost of the mixture. However, the use of Master Builders Solutions' durability-enhancing admixtures can provide significant economic benefits over the life of a structure as illustrated in the following chart.



The bridge on the right is experiencing heavy corrosion. The bridge on the left was built to prevent corrosion by using high performance concrete with durability-enhancing admixtures. Durability issues, such as corrosion of reinforcing steel in roads, bridges, and parking structures, can be effectively addressed with durability-enhancing admixtures from Master Builders Solutions.

Durability Product

This Admixture Performance Guide can be used to select the optimum Master Builders Solutions product(s) to improve specific durability properties.





Master Builders Solutions for the Construction Industry

MasterAir®

Complete Solutions for air entrained concrete

MasterBrace®

Solutions for strengthening and structural adhesives

MasterCast®

Solutions for the manufactured concrete product industry

MasterCell®

Density reducing admixtures

MasterCem®

Solutions for cement manufacture

MasterEase®

Solutions for low viscosity concrete

MasterEmaco®

Solutions for concrete repair

MasterFiber®

Comprehensive solutions for fiber reinforced concrete

MasterFinish®

Solutions for formwork treatment

MasterFlame®

Passive fire protection system

MasterFlow®

Solutions for precision grouting

MasterGlenium®

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

MasterInject®

Solutions for concrete injection

MasterKure®

Solutions for concrete curing

MasterLife®

Solutions for enhanced durability

MasterMatrix®

Advanced rheology control solutions

MasterPolyheed®

High-performance superplasticizer

MasterPozzolith®

Solutions for water-reduced concrete

MasterProtect®

Solutions for concrete protection

MasterRheobuild®

Superplasticizer for concrete

MasterRoc®

Solutions for underground construction

MasterSeal®

Solutions for waterproofing and sealing

MasterSet®

Solutions for set control

MasterTile®

Solutions for tiling systems

MasterTop®

Solutions for industrial and commercial floors

MasterWeld™

Adhesive Solutions for construction

MasterX-Seed®

Advanced accelerator solutions for concrete

Ucrete®

Flooring solutions for harsh environments

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