Master Builders Solutions brand is built on over a century of experience in the construction industry.
That experience has led to the development of the most technologically advanced concrete admixtures for concrete durability.

About Master Builders Solutions

Master Builders Solutions is a leading global manufacturer of concrete admixtures, as well as other sustainable solutions for the construction industry, focussed on delivering its vision: **Inspiring people to build better.** Master Builders Solutions provides 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. Founded in 1909, Master Builders Solutions has ca. 1600 employees operating 35 production sites globally, supporting their customers in mastering their building challenges of today – for a decarbonised future.

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MASTER® BUILDERS SOLUTIONS

Durability Solutions for Concrete

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
- Cracking
- Strength

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.

Master Builders Solutions MasterLife ASR 30 lithium-based admixture is specifically formulated to inhibit deleterious expansion in concrete susceptible to ASR. Lithium in MasterLife ASR 30 admixture forms a gel with reactive silica that is stable and does not absorb water and swell, thus reducing expansion of concrete.

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.

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® M or F Series of synthetic microfibers 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. Relative to conventional shrinkage-reducing admixtures, MasterLife CRA 007 admixture, a first-of-its-kind crack-reducing admixture, provides better performance under restraint, resulting in smaller initial crack widths.

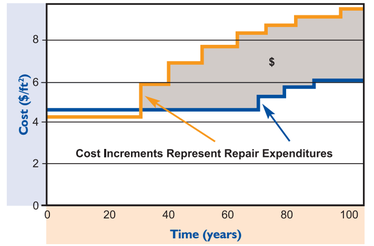
The MasterFiber MAC series of synthetic macrofibers can also be used to hold cracks tight, thereby reducing crack width. Synergistic performance is achieved through the use of these fibers and either the MasterLife SRA admixture series or MasterLife CRA 007 admixture.

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® and MasterRheobuild® 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. In specialized applications, strengths can be increased to 20,000 psi (138 MPa) and higher.

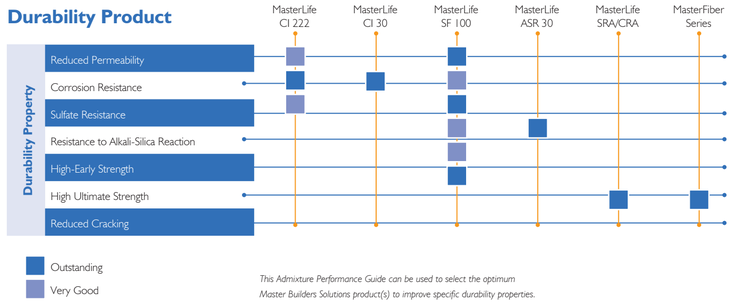
Economic Benefit

Concrete designed for durability will typically increase the initial cost of the mixture. However, the use of Master Builders Solutions durabilty-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.