

Exploring the Key to Sustainable Construction

Ana Juraga Oluic, Content Writer, Cortec Corporation, writes about extending the life of concrete structures through advanced corrosion inhibitors and meeting LEED certification standards.



When it comes to sustainability, the most important thing Cortec® MCI® Technology can do is to help extend the service life of reinforced concrete structures by mitigating corrosion. Because concrete is a major producer of greenhouse gas, the very act of helping concrete last longer means less new concrete is needed to replace the old concrete, thus reducing overall CO₂ output from cement production. Furthermore, MCI® helps contractors and building owners steward resources wisely by repurposing existing structures and sometimes even using renewable materials for construction.

Challenges to Concrete Service Life

To understand MCI's impact on sustainability, it is necessary to look at one of the major challenges to concrete longevity: corrosion. The two main sources of corrosion in concrete are chlorides and carbonation.

For example, a structure with high chloride exposure from proximity to the sea or frequent exposure to deicing salts is likely to corrode much sooner than a reinforced concrete structure in the middle of a dry, landlocked environment. However, even structures in this latter environment can deteriorate over the years as carbonation sets in from exposure to CO₂ in the air. Carbonation reduces the naturally high pH of the concrete so that reinforcement is no longer in the zone of passivity and can corrode more easily. In either case, concrete cracking can make matters worse by allowing corrosives to enter and reach reinforcing steel more quickly.

Helping Concrete Structures Last Longer

MCI® Technology can protect against both types of corrosion by forming a protective molecular layer on the surface of the steel reinforcement. By interfering with the natural corrosion reaction between oxygen,

steel and an electrolyte, MCI® delays time to corrosion and reduces corrosion rates once started. MCI® can be applied as a concrete admixture to new structures or as a surface applied corrosion inhibitor (SACI) to existing structures. It can also be combined with repair mortars or water repellents for dual benefit and application convenience. In this way, both specifying engineers and repair contractors can help their work last longer and be more efficient, reducing the time and labour normally needed for repair. This weighs strongly in favour of earning credits toward LEED certification, a prominent sustainability rating system overseen by the US Green Building Council.

Earning LEED Credits

Earning LEED credits with MCI® can take a two-pronged approach. The main area in which MCI® can help in LEED v4.1 Building Design + Construction is under the credit category of ‘Building Life-Cycle Impact Reduction,’ which looks at ‘Building and Material Reuse,’ as well as the ‘Whole-Building Life-Cycle Assessment.’ By specifying MCI® admixtures in new structures, engineers can reduce the need for concrete repairs and reconstruction to achieve the same service life, thus reducing overall CO2 output over time. In a similar vein, MCI® repair products can help existing structures last longer, thus making it possible to reuse resources that have a high embodied carbon output (carbon emissions from building the structure) instead of demolishing and replacing them. Another way that contractors can earn credits toward LEED certification is by using MCI®-2005, a corrosion inhibiting concrete admixture that protects against both chloride- and carbonation-induced corrosion. MCI®-2005 is a USDA Certified Biobased Product derived from corn. It contains 67 per cent USDA certified biobased content and can contribute to the ‘Responsible Sourcing of Raw Materials’ LEED credit category.

Building for Coastal Resilience

There are many examples of how MCI® has been used in efforts to extend service life by delaying or mitigating corrosion on rusted rebar in concrete. The Lodge at Gulf State Park is an excellent model. Replacing the original lodge that was destroyed by Hurricane Ivan, the new lodge was designed with special goals for sustainability and resilience. A corrosion mitigation strategy was especially important given the corrosive location of the hotel on the Gulf Coast. In addition to MCI®-2005 being a biobased product in line with the project’s overall goal of


LEED certification, MCI®-2005 was also shown to outperform the service life of epoxy-coated rebar (intended for corrosion protection) in service life prediction modelling. Furthermore, it provided significant direct cost savings to the project.

Structural Reuse vs Concrete Demolition

The Höganäs County Water Tower is an excellent example of how MCI® repair materials can be used to restore and prolong the service life of existing structures rather than demolishing them. Although built for a service life of 50 years, the water tower was already deteriorating at age 42, with chunks of concrete falling off due to chloride- and carbonation-induced corrosion. The concern was that additional damage could develop quickly and affect structural integrity. The municipality therefore requested a repair strategy that would provide 20 additional years of service life. The project owners settled on a repair plan that included MCI®-2020 V/O for corrosion mitigation over other proposals that had a shorter expected service life or required demolition.

Meeting Longer Service Life Demands

The sustainability trend is evidenced in the fact that more and more projects are demanding structural service lives of 100 years or more. This is the case of the new Pelješac Bridge, which creates an important link between two separate parts of Croatia. The bridge was designed to have a 130-year service life and therefore incorporated multiple corrosion mitigation strategies to counteract concrete corrosion in the harsh saltwater environment. One of these strategies was the application of MCI®-2018 onto the concrete pylons. This supplied the concrete surfaces with a 100 per cent silane water repellent (to block intrusion of corrosives) and Migrating Corrosion Inhibitors to penetrate and protect embedded steel reinforcement.

The need for concrete corrosion solutions will only get stronger as service life demands increase and sustainability requirements get stricter. MCI® Technology provides a convenient, efficient and effective method of corrosion protection for both new and existing structures, providing an important key to sustainable construction and the long-term reduction of one’s carbon footprint. 

ABOUT THE AUTHOR:

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