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Electrochemical Chloride Extraction

Purdue ECT Team
Purdue University, ectinfo@ecn.purdue.edu

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ELECTROCHEMICAL CHLORIDE EXTRACTION

THE NEED

Conventional methods to deal with chloride-contaminated concrete require the removal of the contaminated concrete and replacement with uncontaminated concrete. These methods are noisy, dirty, time consuming, costly, and in some cases structurally detrimental. The Norcure system is a rehabilitation method developed to remove salt (chloride ions) from salt contaminated concrete structures without damaging the concrete. The removal of chloride ions stops the corrosion of embedded reinforcing steel and greatly extends the service life of salt contaminated structures.

FIGURE 1 ELECTROCHEMICAL CHLORIDE EXTRACTION

THE TECHNOLOGY

The removal of chloride ions and the re-establishment of the passive oxide layer around the reinforcing steel eliminates or greatly reduces on-going rebar corrosion. Chloride ions can be drawn out of the concrete by applying a direct current electric field between a temporary anode at the surface of the concrete and the reinforcing steel (cathode) within the concrete. Chloride ions carry a net negative charge, and thus migrate from areas near the reinforcing steel toward the surface mounted anode, and out of the concrete. Simultaneously, hydroxyl ions are produced around the rebar within the concrete. The hydroxyl restores a highly alkaline environment around the rebar, further suppressing corrosion of the steel.

THE BENEFITS

The Norcure process is a quiet, clean and nondestructive method. The process takes about four to eight weeks to reduce the chloride ions in the vicinity of the reinforcing steel to levels required to prevent corrosion. The combined effects of removing chloride ions and restoring an alkaline environment around the steel provide a long life for the structure, free from corrosion.

A sister technology is also being used to re-alkalize concrete damaged through carbonation. Experimental work is underway examining the application of lithium-based electrolytes for their ability to mitigate damage caused by alkali-silica reactive aggregate in concrete.

STATUS

Trial demonstration projects using the Norcure system began in 1989. The first trial project in North America was for the Ontario Ministry of Transportation on a portion of the substructure of the [Burlington Skyway](#). This project was completed as part of the Strategic Highway Research Program (SHRP) which is a jointly funded program of the U.S. and Canada. The first full-scale commercial project in North America was completed in 1994 on a bridge substructure for [Saskatchewan Highways and Transportation](#). The project included the treatment of 24 salt contaminated columns.

In recent years projects have been undertaken throughout many parts of North America, Europe, and Australia; as well as parts of Asia and the Middle East. Acceptance of the system seems to be growing rapidly now that the long-term results of the early SHRP test projects are available. The Federal Highway Administration is actively promoting the use of this technology to state DOT's because it presents a viable option for extending the life of existing structures, and saving money in the process. About 5,000,000 sq. ft. of concrete has been treated to date.

BARRIERS

- Epoxy coated reinforcing steel – insulates the reinforcing steel preventing electrical continuity, and effective chloride removal.
- Pre-stressed or post-tensioned steel – potential risk of creating hydrogen embrittlement in the reinforcing steel through application of a voltage as used in a chloride extraction or cathodic protection system.

POINTS OF CONTACT

Chris Ball, Vector Corrosion Technologies

Email: chrisb@vectorgroup.com

Daniel Burns, Gemite Products, Inc.

Tel: (701) 280-9697, Email: danb@vectorgroup.com

Sean Abbott, Gemite Products, Inc.

Tel: (204) 489-6300, Email: seana@vectorgroup.com

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REVIEWERS

Peer reviewed as an emerging construction technology

DISCLAIMER

Purdue University does not endorse this technology or represents that the information presented can be relied upon without further investigation.

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