



EPOXY COATING

BULLETIN

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A REPORT BY THE PROTECTION AND COATINGS COMMITTEE OF
THE REINFORCING STEEL INSTITUTE OF CANADA

VOLUME 1

SUMMER 1993

Coating Technology Improves in Ontario

As a result of research and studies presented by the participants of the **Transportation Research Board (TRB)** Annual Meeting in January, 1993, and the findings of a **Ministry of Transportation of Ontario (MTO)** study of epoxy coated rebar cored from existing bridge decks, the Ontario epoxy coating members of the **Reinforcing Steel Institute of Canada (RSIC)** have initiated improvements in the coating technology used in their rebar plants. New coating processes are now implemented to improve the adhesion of the epoxy coating to the steel, and new quality assurance tests have been added to prove that adhesion.

RSIC member coating plants in Ontario are adding primer application systems to their processes to increase the adhesion of the coated bar. As bars pass through the coating

line, a primer is applied to the cleaned steel prior to coating. Studies of this method, performed in North America and Europe, have shown dramatic improvements in coating adhesion.

Three tests, developed from the CSA Standard for Pipe Coatings, and the British Standard for Epoxy Coated Rebar, are currently being used to gauge coating adhesion. A hot water test, a cathodic disbondment test, and a salt spray test (see table, right) are currently being proposed by the MTO as proof tests for epoxy coated bar. While the MTO is currently revising the Ontario Provincial Standard Specifications (OPSS) to include these tests, these specifications will not be in effect until late 1993. However, the RSIC epoxy coaters have begun to produce bars with improved adhesion, as measured by the three tests, as of July 1, 1993.

These quality improvements will spread. The Ontario RSIC coaters operate plants outside of Ontario, in Canada, the United States, and around the world, and will transfer the

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Proposed Epoxy Coated Rebar

Adhesion Tests

1. Hot Water Soak: sample bars are placed in 75°C tap water for 48 hours. Upon removal, coating is scribed and bar is allowed to cool. Adhesion is rated by the resistance of the scribed coating to prying.

2. Cathodic Disbondment Test: holiday free sample bars are intentionally damaged with a 3 mm dia. break in the coating. They are then placed in room temperature, 3% NaCl solution and connected to a 1.5 volt DC power source for 7 days. Upon removal, the coating is scribed. Adhesion is rated by the disbondment radius from the intentional hole to the edge of the area showing firm adhesion.

3. Salt Spray (Fog) Test: sample bars are damaged intentionally and placed in a salt spray cabinet for 800 hours. Coating is scribed near damaged areas after removal and allowed to dry for 24 hours. Adhesion is tested by attempts to pry up the coating with a knife.

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The Protection and Coating Committee of the Reinforcing Steel Institute of Canada has produced this report to provide owners, designers, specifiers, and contractors with up-to-date, sound information on the epoxy coated reinforcing steel industry.

Research Continues for RSIC PCC

The Protection and Coating Committee of the RSIC sponsors, co-sponsors, and is a participant in several studies and research projects ongoing across North America. The following briefly describes the research work performed for us. If you require more information, please contact the RSIC at 416-499-4000 for more information.

A. Surface Science Western

Headed by **Stewart MacIntyre** and **T. Walzak**, Surface Science Western (SSW) at the **University of Western Ontario** in London, Ontario has tackled some interesting and important research topics for the RSIC Protection and Coating Committee, the MTO, and the Concrete Reinforcing Steel Institute (CRSI) in the United States.

An **Adhesion Mechanism Study** is currently being undertaken by the SSW team to determine the mechanism of disbondment due to the absorption of water by epoxy coatings. This study is jointly funded by the MTO, CRSI, and a research grant available under the National Scientific Engineering Research Council (NSERC). The objective of the study is to "view" the changes in bond due to several variables by using various non-intrusive methods. Results are expected by early 1994 and will form the first step in a three step process to determine and test for adhesion in epoxy coated reinforcing bars.

SSW completed **Characterization of Steel Rebar Surfaces During Epoxy Coating Process** for the RSIC earlier this year. Samples were taken from a working epoxy coating line and analysed for surface contamination. The study concluded that exposure of the cleaned bar to the shop environment for up to

60 minutes did not result in any significant change in the surface chemistry.

University of New Brunswick

Professor **Ted Bremner** of the University of New Brunswick is continuing work begun four years ago on **corrosion resistance of epoxy coated reinforcing steel**. Phase I of this study was presented at the January TRB meeting. The research examined corrosion of epoxy coated steel under controlled laboratory and outdoor tidal sea-water conditions. To date, the epoxy steel has shown excellent corrosion performance under severe exposure conditions. Research is continuing.

McGill University

Professor **Dennis Mitchell** has been working to gain a better understanding of the influence of epoxy coating on structural performance of reinforced concrete. The project is to be done in four phases: **bond strength tests; tension tests, simple span beam tests, and full scale slab/column connection tests** each to determine

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crack control characteristics of coated and uncoated bars. Final results and a report are expected in late 1993.

University of Waterloo

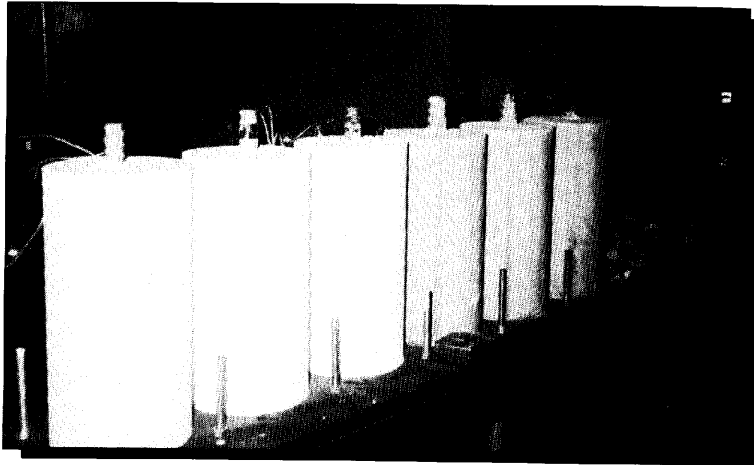
Professor Robert McKim, of the Department of Civil Engineering, is overseeing a Master of Engineering thesis performed by Ken Logtenberg to study **damage to epoxy coated steel** as it moves through the chain from fabrication to placement in the formwork and after consolidation of the concrete. The study will use statistical sampling as well as the inspection of actual bars traced through the coated rebar distribution channels, from coating through fabrication, placing, and concrete pouring and consolidation (removed from concrete pours. The results are expected in fall of 1993.

Bar Geometry, Mill Practice Aid in Coating Quality

Rebar producers have made, and are making changes to improve the quality of reinforcing steel for epoxy-coating:

- ♦ The geometry of the rib has been improved to help meet coating requirements.
- ♦ Mill practices and packaging have been altered to produce bars with improved straightness and bundle quality
- ♦ Bundles are now protected from road salt during transportation.

The rebar producers are committed to ongoing developments that will improve the "coatability" of rebar to ensure a more uniformly coated and more corrosion resistant product.



Canadian Strategic Highway Research Program

Together with the RSIC, CSHRP is performing a study of the effect of exposure on the quality of epoxy coated steel. Bars will be placed in three distinctly different location across Canada: New Brunswick, Ontario, and Alberta. The study is expected to improve specifications on the storage of epoxy coated rebar. The first phase of the study, using untreated epoxy coated bars, has begun. The second phase, using new technology bars will begin in August

1993. Each study will expose the bars for one year.

Ministry of Transportation, Ontario

The MTO Research Department, under **David Manning** has recently completed an in-house study of **steel tipped vibrator damage** to epoxy coated rebar caused during concrete consolidation. The results showed significant damage to the epoxy coating due to vibration and has prompted the MTO to require rubber tips on all concrete vibrators in structures using epoxy coated rebar.

RSIC Protection and Coating Committee - Who We Are

The Protection and Coating Committee, formed from the membership of the Reinforcing Steel Institute of Canada, is a group of concerned industry coating specialists whose goal is to monitor the development of corrosion protection systems for reinforced concrete; to evaluate and monitor research and changes in specifications; and to establish and promote standard coating practice. The membership is drawn from bar coaters and fabricators, steel mills, and powder manufacturers who provide engineers, metallurgists and coating specialists.

This report is our first step in informing the engineering, specifying, and contracting community of the exciting changes in the epoxy coated rebar industry. If you have any questions, concerns, or comments, or require any information about epoxy coated reinforcing steel, call the RSIC at 416-499-4000. The staff will direct you to the members on the committee who will best be able to respond to your inquiry.

The Protection and Coating Committee of the RSIC

Epoxy Rebar: Still The Best Value

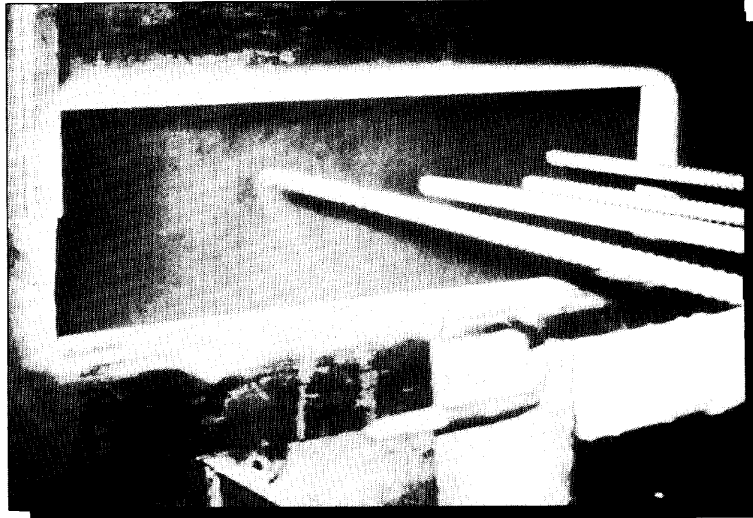
With the improvement in adhesion properties, epoxy coated rebar again becomes the the most economical method of corrosion protection for concrete construction. The corrosion protection properties of epoxy coating are always present; its protection is available from the moment it is installed. It cannot wash off and protects the steel in corrosive environments whether or not the concrete is cracked.

Properly handled and placed, epoxy coatings will not degrade over time. Concrete structures built with epoxy coated rebar require only the monitoring and inspection resources required for any well thought-out maintenance program.

Epoxy coated rebar has a long history of some very good performance. With improved adhesion, its performance will only get better.

CRSI Certification Endorsed By RSIC

The Reinforcing Steel Institute of Canada recognizes and endorses the CRSI Voluntary Certification Program for Fusion-Bonded Epoxy Coating Applicator Plants as an effective tool in maintaining a uniformly high level of excellence in



plant facilities, production procedures, and quality assurance. The program offers direction on many components of plant operations that are not addressed in specifications but are required to maintain a high level of quality assurance.

The Concrete Reinforcing Steel Institute (CRSI) has now reported 18 certified epoxy coating plants in North America. The plants have been inspected and graded by an independent agency, (Wiss, Janney, Elstner Associates (WJE) of Northbrook Illinois). WJE performs an announced initial inspection and subsequent unannounced inspections to ensure continued compliance to the program. On average, these plants have increased their certification grades after their second, unannounced, inspection.

We encourage owners, architects, and engineers to specify and recommend this certification program on their projects. Copies of this program are available through CRSI (phone 708-517-1200, Att: Mr. Ted Neff) for the cost of \$US 15.00 per copy.

Coated Rebar Improves

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technology to them. As the year progresses and the results of various industry and specifier research is concluded (see **Research Continues**, this issue), product improvement will continue. The RSIC member epoxy coated rebar producers are committed to improved corrosion protection.



Epoxy Coating Bulletin is a publication of the Reinforcing Steel Institute of Canada, 1 Sparks Ave., Willowdale, Ontario M2H 2W1.