

anti-corrosion times

Reporting on industry news, noteworthy applications and new developments of the fusion bonded coating system for corrosion prevention.

New FHWA Research Confirms Integrity of Epoxy-Coated Rebars

Working under a Grant authorized by the FHWA, the Northbrook, Illinois firm of Wiss, Janney, Elstner Associates, Inc., conducted a comprehensive corrosion research study of ten different corrosion prevention systems. 124 reinforced concrete slabs were tested using an accelerated 48-week laboratory cyclic testing method. Variables included W/C ratios of 0.50, 0.40 and 0.32 and clear cover of 1, 2, and 3 in. over embedded reinforcing bars or prestressing strand. Slabs cast with FUSION BONDED EPOXY COATED REBARS or STRAND, were subjected to the same cyclic corrosion tests as slabs incorporating conventional UNCOATED REBARS or STRAND, as well as slabs cast with galvanized bars.

Likewise, slabs were separately cast and tested utilizing CALCIUM NITRITE as a corrosion inhibiting admixture, a penetrating SILANE SEALER system and a METHACRYLATE COATING system. Slabs for each of these three individual systems utilized conventional uncoated rebars.

Corrosion activity of the embedded bars or strand within each slab was monitored to measure macrocell corrosion current. Chloride ion content profiles were determined at the initiation of corrosion activity, as well as after 44 weeks of cyclic testing to evaluate effects of W/C ratio and clear cover on ingress of chloride ion into concrete structures.



Epoxy-Coated Bar is shown alongside a severely rusted bar. Both were embedded in identical concrete slabs and subjected to the same 48-week cyclic corrosion tests. Subsequently, the bars were disengaged from the concrete for visual examination.

The Epoxy-Coating remained intact throughout 48 weeks. The bar showed no sign of corrosion activity at the end of the period — even at the point where a holiday existed (identified by black paint mark visible in the photo). White portions are residual concrete adhering to the bar surfaces.

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INTERSTATE BRIDGE SUBSTRUCTURE REHAB FOR LONG FUTURE

The Arkansas River makes a long, twisting, 1,450 mile journey from central Colorado to the Mississippi River. Growing from a small fresh-water mountain stream, it gains volume and silt to become a large river near Little Rock, AK where the Arkansas I-430 bridge makes its crossing.

After ten years, cracks in five of the large mass concrete subcaps were detected. To protect against deterioration of existing rebar, the Arkansas Department of Transportation decided to encase twelve subcaps.

Collaborating with consulting engineers, Engstrom/Modjeski and Masters, Little Rock, the Arkansas State Highway Commission tackled and solved the problem. Cofferdams are constructed around the existing subcaps and the areas de-watered. After the concrete is cleaned, forms are constructed to surround the subcaps and epoxy-coated reinforcing steel is installed. Concrete is then placed in the oversize caps. The caps are extended to enclose the lower portions of the piers as further protection for the bridge substructure.

Because of the very large radius of the bars, straight lengths of the epoxy-coated reinforcing steel were shipped for job site fabrication. Splices would have added to the congestion in the heavily reinforced caps. Further, to ship the

large radius formed rebars would have posed transportation problems. Altogether, 14,000 tons of no. 7, 8 and 9 Grade 60 epoxy-coated rebar are being used, with 150 tons of the large radius bars job site fabricated by the steel supplier's crew.

Bid at \$5,942,000, this major reconstruction project will be completed in 1986.



Large rebar radius is apparent in this job-site fabrication set up.

The rehabilitated substructure is corrosion-protected with epoxy-coated rebars.



Brand New 70 Year Old Frank Lloyd Wright Bridge



The only bridge ever designed by Frank Lloyd Wright was built of reinforced concrete. The time was 1915. The place, Glencoe, Illinois, a north shore suburb of Chicago.

Now, after 70 years of wear and tear of Chicago's famous winters and dosages of deicing salts, the old structure has given way to a new span.

The historical significance of Wright's only bridge design plus the nostalgic value of the structure, prompted Glencoe and Illinois Dept. of Transportation officials to duplicate the original structure — but with one very big difference: This time grade 60 epoxy-coated reinforcing steel was specified. The deck, walkways and railings all were constructed with this corrosion prevention system.

Today, the new \$365,000 span is ready for what should be an even longer term

The original Wright bridge — a unique design of what amounts to a bridge constructed on a concrete arch culvert.

of service to the residents of this exclusive community which also boasts three Frank Lloyd Wright homes. *Engineers for the project: Hampton, Lenzini & Renwick, Elgin, Illinois. Contractor Eric Bolander Construction Co., Libertyville, Illinois.*

Ironworkers complete tying the epoxy-coated reinforcing steel on the new Wright bridge. Both mats are epoxy-coated.



Coast Guard Solves Salty Situation

Key West, Florida is noted for its brilliant sunrises on one side — and gorgeous sunsets on the other. But, being this close to salt water makes it a terrible atmosphere for steel.

The Coast Guard, in planning a new 4-story "unaccompanied personnel housing" facility at the Truman Annex, wisely considered the corrosion hazard and called for epoxy-coated rebar in the 42,000 square foot building. The foundation and entire superstructure of the hurricane-proof reinforced concrete building utilized 140 tons of Grade 60 epoxy-coated rebar to stand up to Key West's corrosive attacks.

FHWA Research

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Findings of the study, according to the Co-principal investigators, Donald Pfeifer and Robert Landgren, show that concrete W/C ratio has a dramatic influence on ingress of the chloride ion, particularly when reduced from 0.50 to 0.40. Further, the study results point up the fact that 1" CLEAR COVER provides inadequate protection for unprotected conventional bars — irrespective of W/C ratio variation from 0.50 to 0.32. (Specimens with 2 and 3 inches of clear cover generally did not exhibit corrosion activity during this 48-week test period.) These two significant conclusions substantiate similar previous FHWA research.

Tests showed that Epoxy-Coated Rebar specimens (top mat only or both mats coated), having 1, 2, and 3 inches of cover with all W/C ratios, showed no signs of corrosion activity. Likewise, Epoxy-Coated prestressing strand specimens (having 1, 2, and 3 inch cover with all W/C ratios) showed no signs of corrosion activity. Meantime, companion slabs with unprotected conventional bars (or prestressing strand) revealed evidence of moderate to severe corrosion.

Specimens with GALVANIZED BARS used in the top mat only (with 1 inch cover and 0.50 W/C ratio) showed traces of red rust after 44 weeks. The companion specimens with both mats GALVANIZED showed no steel corrosion over the same period. Microscopic examination after 48 weeks of testing revealed zinc corrosion which was locally removing the zinc layer; however, none of these localized corroded spots were more than half-way through the zinc coating on the bars tested with both mats galvanized.

The CALCIUM NITRITE, SILANE SEALER AND METHACRYLATE specimens with 1 inch cover and 0.50 W/C ratio all exhibited corrosion, but generally, at a significantly reduced rate when compared to normal uncoated bars in unprotected concrete.

Full scale tests on reinforced columns and beams, prestressed piles and sub-deck panels are underway in Phase II on the corrosion protection concepts which showed good to excellent performance in Phase I. An interim report on Phase I has been submitted to the FHWA by Wiss, Janney, Elstner Associates, Incorporated.



New Jersey Specs Epoxy-Coated Rebar For Turnpike Median Barriers

Highway median barriers have tough lives. Standing guard to improve the prevention of cars and trucks from invading oncoming traffic lanes, they're often subject to impact and sliding abrasion.

Even more destructive in the long run is the intrusion of salt spray where deicing practices are essential — like in New Jersey. That's why the engineers of the

New Jersey Turnpike now dictate epoxy-coated reinforcing steel be used in its slip-formed concrete barriers in high traffic areas.

New barrier contracts totaling more than \$5 million are now being completed, with over 5-1/2 miles of the barrier going in service between New Brunswick and the Holland tunnel under the Hudson River.



Montana Wastewater Plant Gears Up For Year 2002

You have to plan for the future. Way ahead when it concerns vital public services where long design and construct times are the rule. Case in point: waste treatment.

Lewiston, Montana, with a population of 7,400 today, envisions a 24% increase by the year 2002: 9,200 citizens.

Because time flies, Lewiston public works officials with the aid of its consulting engineering firm, HKM Associates, Billings, are upgrading and increasing capacity of its waste treatment plant to 2.8 MGD. Saving two primary clarifier tanks, and upgrading the treatment plant process to meet EPA secondary discharge standards, this centrally located Montana city is incorporating the latest technology in its modernization program. Naturally, this includes the use of epoxy-coated reinforcing steel in the 70 foot diameter secondary clarifiers, the 50 foot diameter anaerobic digesters, and the 70 foot by 75 foot rotating biological contact basin. The treatment of sewage, human and industrial wastes, is a highly corrosive process; so Lewiston is buying insurance of lasting future plant performance at a very low premium by specifying epoxy-coated reinforcing steel.

High Strength Concrete Bridge a Winner for Beauty and Low Cost

Concrete chalks up two more firsts: the new bridge at East Huntington, West Virginia, over the Ohio River to Proctor-

ville, Ohio, is made of the strongest concrete so far used in the construction of an American bridge, 8,000 psi, 28-days — and is unique for its design.

It's the first major American asymmetrical stayed girder structure. Cables from a single 420 foot high pylon support the main girder which will be 900 feet long on one side of the pylon and 608 feet long on the other side.

When the job was put out for bids, the bridge could be built in either concrete or steel. Of the three bids, each for concrete and steel, the winning concrete design was 29% under the lowest steel price.

The slim, striking beauty of the span comes from its cast-in-place segmental concrete spans at its south end and 5 foot deep precast segmental elements in its main span. Total bridge length is 1,993 feet. Epoxy-coating was specified for all critical components where corrosion due to deicing practices could be future problem areas. The designers, Arvid Grant & Associates, Inc., Olympia, Washington, and West Virginia Highway Department wanted to be certain this beauty made a lasting impression.



CRSI-ECC To Be At ASCE

The fall meeting of the American Society of Civil Engineers (ASCE) will bring together 3,000 of these professionals in Detroit, October 21-25. With the increasing interest of civil engineers in epoxy-coating as a means of effectively preventing future corrosion problems, experts in the CRSI-Epoxy Coating Committees booth expect to be busy providing the latest information on the subject to attendees. If your plans will take you to this meeting, stop by.

Parking Magazine Tells Readers How To Put Brakes On Ramp Spalling



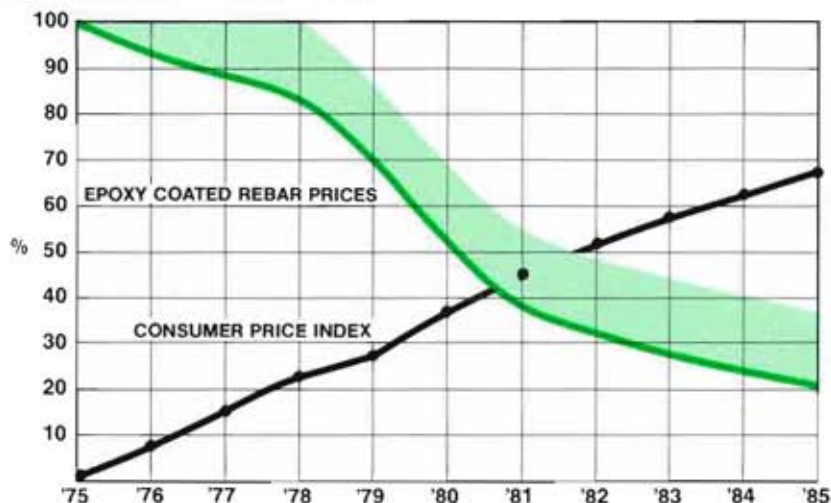
A 3-page, in-depth article in the March-April issue of PARKING magazine reported to its 6,500 readers — design engineers, owners and operators of parking structures — on the latest means of concrete ramp protection. Authored by Robert T. Stafford, Director of Epoxy Coating Committees of the Concrete Reinforcing Steel Institute, the report tells how epoxy-coating of the reinforcing steel isolates the steel from air and moisture, thereby protecting against penetration of destructive chloride ions. Several case history examples are included. For a copy of this informative editorial, contact Robert T. Stafford, CRSI-Epoxy Coating Committees.

Biking Across the Brooklyn Bridge

As the world famous Brooklyn bridge enters its second century of service, it offers special accommodation to the



Epoxy-Coated Rebar Has Dramatic Usage Gain, Price Drop



USER COST TREND EPOXY-COATED REBARS SHOWN AS % OF UNCOATED REBARS

An editorial in the July '84 issue of Anti-Corrosion Times reported on the impressive price reduction of epoxy-coated rebars over the past decade — while inflation increased significantly. Today, one year later, the trend toward "lower user cost" continues, occasioned by ever increasing industry productivity and competitiveness.

The chart graphically demonstrates how epoxy-coated reinforcing steel has be-

come the nation's most economically practical system of corrosion prevention. The lower dark line of the descending curve represents the lowest "in place" bid prices published periodically over an 11 year period. The shaded area above the line exemplifies the existence of potentially higher prices at any given point of time — higher because of relatively small quantity and/or greater complexity of design.

Ad Featuring Epoxy-Coated Rebars For Garages is High ENR Inquiry Producer

For the third time in a row, the CRSI-Epoxy Coating ad in the big annual Concrete Supplement in May ENGINEERING NEWS-RECORD turned in winning response by readers — indicating the appetite engineers and contractors have for more knowledge on this concrete corrosion prevention system. The ad was tops for inquiry production. Shouldn't you have the facts on epoxy-coated reinforcing steel, too? Call or write.



Seminars on Epoxy-Coated Rebar

The Concrete Reinforcing Steel Institute in conjunction with its chapters and the Epoxy Coating Committees of CRSI has been presenting nation wide seminars entitled "Epoxy-Coated Rebar — A Corrosion Protective System". The concentrated seminars provide engineers, architects and contractors with the most efficient methods of using epoxy-coated reinforcing steel in the design and construction of bridges, parking structures, corrosive industrial environments and marine structures. Particular attention is paid to project specifications, the rebar coating process and the handling, storing and installation of epoxy-coated rebar. Seminar speakers are experts in their field.

Tentative fall meetings are now being planned. If you would like to be informed of dates and locations, contact Robert T. Stafford at CRSI-Epoxy Coating Committees. Engineering firms interested in presenting in-house seminars should talk to Robert T. Stafford.