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JOURNAL OF PROTECTIVE COATINGS & LININGS

The Voice of SSPC: The Society for Protective Coatings

FEATURES

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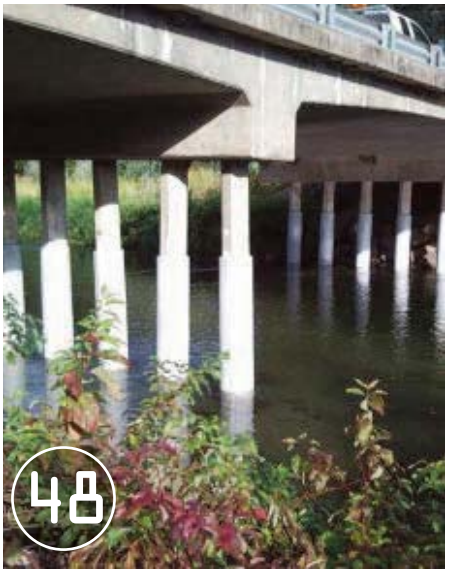

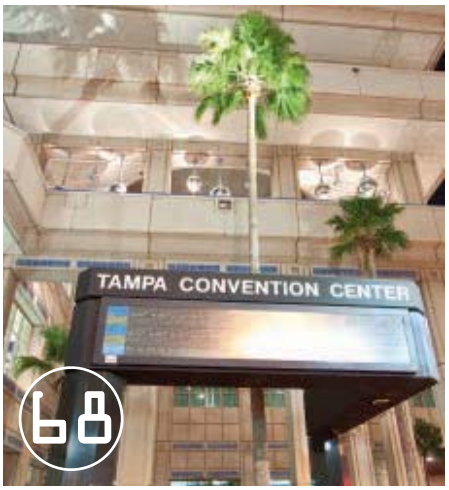

DEPARTMENTS

Also This Month

From the Offices of

Staff

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My 2012 Resolutions and a Note about SSPC

I would like to share my New Year's resolutions for the coming year. I always begin by wishing the readership and their families good health in 2012. We all worry about our jobs, especially during these tough economic times. We all seem to be working harder than ever before and experiencing more stress and distractions. This makes maintaining good health more difficult than ever before. We need to balance our professional lives with our personal lives and regain some of the personal time we have sacrificed in recent years. We need to rediscover those stress relievers to reduce that element that is so destructive to our personal wellbeing. Years ago, when I was having cardiac problems, I remember my doctor saying to me, "When are you going to give it up and find a job, like working at Home Depot, that relieves your stress?" Of course he was not minimizing working at Home Depot; he was suggesting a job that he felt would be less of a grind on my health. I gave a great, well thought out response, "Beats the hell out of me!"

My second wish for the New Year is that we, as Americans, exercise our right to vote in both the primary and general elections to determine our nation's leadership for the next four years. Participation in Presidential election years far exceeds the turnout in "off-years;" however, the numbers are dismal. In 2000, only 51.3% of eligible voters exercised their right to vote. In 2004, the number increased to 55.3%, and in 2008, it went up to 56.8%. In off-year elections, the average is around 37%. When you look around the world and see people in other countries fight for and, in some cases, give their lives for the privilege of participating in the democratic process, we as Americans should be ashamed of not participating in ours. I hope that Congress will address the problems that the nation is facing in a bi-partisan, non-political manner so that our democracy can flourish. I want the constant gridlock in Washington to cease and for both major parties to seek and achieve compromise that will hopefully help this great nation to attain future success.

I wish the Iraqi government and its citizens peace and stability for the future. As of the end of 2011, almost all of our forces are out of Iraq. As of this writing, it has been documented that since 2003, 4,483 U.S. troops have been killed and over 30,000 have been seriously wounded. These casualties would be a terrible price to pay if Iraq returns to a dictatorship or if violence and lawlessness rule. I also wish God speed to the troops in Afghanistan, as they execute the orders of our nation's civilian leadership. I will state two facts: first, armed conflict is an instrument of national policy, and it should be used as a final resort; and second, I know firsthand that no one abhors war more than soldiers because they put their lives in harm's way in order to execute the directives of our civilian leadership. It will be a great day when all individuals who are deployed either return home or are accounted for.

Lastly, I would like to give you a note about SSPC for the coming year. The Board is seeking to establish a long-range goal and objective for the Society. We once had a consultant who called this the BAG—Big Audacious Goal. The staff will be presenting a "draft" BAG to the Board in January. From there, the staff will develop a plan that will include incremental milestones. The resultant document will be the roadmap for the direction the Society will be taking for the specified timeframe. If you have ideas for our BAG, please let us know.

Again, I wish everyone good health, prosperity, and the best of luck in 2012. I really appreciate everyone's support of SSPC.

Bill

Bill Shoup
Executive Director, SSPC

February Webinars:

Fluoropolymers for Bridges, Quality Control, and Measuring Adhesion to Concrete

The *SSPC/JPCL Webinar Education Series* will include three webinars during the month of February: "Field-Applied Fluoropolymer Coatings for Bridges" on February 8, "Quality Control of Industrial Painting Operations" on February 15, and "Measuring Adhesion to Concrete" on Leap Day, February 29. All three webinars are scheduled for 11:00 a.m. to Noon EDT, and participation is free.

Fluoropolymer Coatings for Bridges

Bob Parker of AGC Chemicals will present the webinar on using field-applied fluoropolymer topcoats on bridges. He will explain the main reasons why these coatings should be considered for bridges, including long-term color and gloss retention, excellent corrosion resistance, and reduced life cycle costs. He will also review the experience of Japan in requiring fluoropolymer coatings on bridges. AGC Chemicals is the sponsor of the webinar.

Bob Parker

Quality Control of Coating Work

The webinar, "Quality Control of Industrial Painting Operations," will be presented by Bill Corbett of KTA-Tator and will focus on describing the fundamental steps that need to be followed to assure successful and high-quality coating work. The webinar will describe and explain industry standards of quality, as well as inspection processes and equipment that can be used to verify compliance with a project specification. The webinar is sponsored by DeFelsko.

Bill Corbett

Measuring Coatings Adhesion to Concrete

David Beamish of DeFelsko will present the webinar, "Measuring Adhesion to Concrete." He will explain how to perform an adhesion pull-off test on coatings over concrete according to ASTM D 7234 and will review and discuss the variables that can affect the results. DeFelsko is the sponsor of the webinar.

David Beamish

SSPC is an accredited training provider for the Florida Board of Professional Engineers (FBPE). PEs in Florida can now submit SSPC Webinar Exam CEUs to the FBPE. If interested in submitting Webinar Exam CEUs to the FBPE, you must download the FBPE CEU form and successfully pass the Webinar Exam. Participation in the webinars is free, but for those who wish to receive continuing education credits from SSPC, a test is available after each webinar. Cost of the test service is $25. You can register through the

SSPC Board Seeks Nominees

SSPC is now seeking nominations for three seats on its Board of Governors in the categories of Facility Owners, where there is one opening, and Other Product Suppliers, where there are two openings.

The Facility Owners category is defined in the bylaws as "individuals who are employed by public or private sector owners of assets who are responsible for the maintenance of coatings of heavy or light industrial structures and surfaces."

The Other Product Suppliers category is defined in the bylaws as "individuals who own, are employed by, or represent firms that manufacture or distribute equipment, abrasive, or peripheral products for use in the protective coatings industry."

All nominees must be SSPC members. To nominate a candidate, SSPC asks that individuals submit a brief statement detailing the nominee's qualifications by March 1, 2012, to SSPC, Attn. Bill Shoup, Executive Director, 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656; fax 412-281-9992; email: shoup@sspc.org.

SSPC Marketplace.

SSPC/JPCL Education Series Webinars provide continuing education for SSPC re-certifications as well as technology updates on important topics.

Paint BidTracker Launches New Website

A newer, faster version of Paint BidTracker, www.paintbidtracker.com, has been launched. Paint BidTracker, the only construction reporting service devoted to the paint and coatings industry, delivers bid intelligence to contractors, consultants, and suppliers via e-mail and offers on-demand access through an intuitive, searchable database. The new site utilizes tag-based technology, faster servers, and updated software to create a smooth, customizable user experience.

Non-subscribers can use the many new, free resources for coating professionals, which include a complimentary bid posting tool for engineers, facility owners, and contractors seeking sub-bidders. "We're very excited to provide additional value to both our current subscribers and new users through faster, more effective technology and an improved organization system," said Brian Churray, Paint BidTracker product manager.

As a result, the service will now include broader coverage of specialty coatings work, with additional opportunities for floor coatings, roof coatings, EIFS, waterproofing, and cathodic protection.

Heavily influenced by user feedback, many of the improvements focus on time-saving functions and workflow enhancements. Customers will now be able to e-mail individual reports, export spreadsheets of search results, and save reports as PDFs. A 5-year archive of painting bid results also is available for market research purposes.

For information or a free trial, visit www.paintbidtracker.com or join Paint BidTracker at SSPC 2012 in Tampa, FL, Jan. 31–Feb. 2 for a comprehensive demonstration.

Paint BidTracker is a service of Technology Publishing Company, whose portfolio includes *JPCL*, *PaintSquare News*, and *Durability + Design*.

Ernst Toussaint of Sherwin-Williams Achieves SSPC Master Coatings Inspector Status

Ernst Toussaint has become the fifth coatings professional to achieve SSPC's prestigious Master Coating Inspector (MCI) status. To reach the MCI level, one must qualify for certification as a Concrete Coating Inspector (CCI) as well as qualify for two of the three other SSPC inspector programs: Bridge Coatings Inspector (BCI), Protective Coatings Inspector (PCI), and the NAVSEA Basic Paint Inspector Course (NBPI), which SSPC administers on behalf of Naval Sea Systems Command. Toussaint is qualified as a CCI Level II, BCI Level II, and PCI Level II Inspector.

Ernst Toussaint

Toussaint is employed by The Sherwin-Williams Company, where he works as a global strategic account manager—engineering. He graduated from the University of Florida with a BS in chemical engineering. In addition to his SSPC inspector certifications, he holds SSPC's Protective Coating Specialist (PCS) certification; is a NACE Level III Certified Coating Inspector; and is a lead instructor for several SSPC courses, including Fundamentals of Protective Coatings (C1), BCI, PCI, and CCI. He also chairs the SSPC Instructor Committee.

Toussaint said, "Obtaining the prestigious Master Coating Inspector certificate brought me closer to not only understanding coatings, but how industrial coating projects are supposed to be inspected throughout the stages of coating application. With regard to being awarded both the PCS and MCI certification, I am honored to be able to contribute to our coatings industry."

The goal of the MCI program is solely to recognize and honor those individuals whose experience and training has afforded them the prestige of multiple inspector certifications. SSPC recognizes that it takes tremendous personal commitment, and that task in and of itself is a core reason why so many of those people are so widely respected.

For more information on how to become an MCI, contact Terry Sowers at 877-281-7772, ext. 2219, or sowers@sspc.org.

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Painted Weathering Steel vs. Painted Carbon Steel

What is the service life of a painted weathering steel bridge, compared to a painted carbon steel bridge in the same service environment?

From Ishita Bhattacharya
Berger Paints India Ltd

A painted weathering steel bridge will certainly perform better than a painted carbon steel bridge in the same service environment. Weathering steel can serve without a coating under normal humid environmental conditions but fails in a severe saline condition. It is then when the coating will serve as protection against corrosion. Moreover, weathering steel needs to be exposed to alternating wetting and drying cycles to develop the protective layer. To conclude, a painted weathering steel will perform better than painted carbon steel bridge in any environment.

From James Albertoni
CH2M HILL

Ultimately, it depends on the environment. Theoretically, the painted weathering steel should have a longer service life because after the paint has failed, the weathering steel will corrode at a slower rate than plain steel. This, of course, is assuming that the weathering steel can be exposed to alternating wetting and drying cycles to form its protective corrosion product. Also, if you are too close to the ocean, weathering steel does not perform well. If you have the proper conditions for weathering steel, I don't see why you would want to paint it. It is a look that is attractive to some architects and capable of meeting most design lifes. As always, be aware that weathering steel produces rust-colored runoff that will stain everything it touches.

Reader Response

On Coal Tar Epoxies and Coal Tar Enamels
From Al Beitelman
U.S. Army Corps of Engineers | Paint Technology Center

The November Problem Solving Forum asked: "What is the preferred method to remove 25-year-old coal tar epoxy from a carbon steel tank in order to reline it?"

It appears that there is some confusion about the difference between coal tar epoxy and coal tar enamel.

Coal tar enamel is a hot-applied coal tar product that has essentially disappeared from the field-applied coatings inventory because of health concerns associated with applying the material. (Factory application, especially on small diameter pipe, is still somewhat common.)

Specifications called for it to be applied a minimum of 1/32 inch (31 mils) thick, but because the typical method of application was by mop, thicknesses in the bottoms of tanks and on other horizontal surfaces could often reach ¼ to ½ inch (250 to 500 mils). Abrasive blasting produces heat. During abrasive blasting of coal tar enamel, the heat softens the coating, causing it to flow and making it extremely difficult to be removed.

As one respondent correctly stated, working in cold weather is beneficial. Moreover, better methods of removal are those that do not create heat, such as ultra-high-pressure (UHP) water jetting or the use of impact

tools. These methods are typically followed by abrasive blasting to remove residual material and produce a required profile. Even after high-quality blasting, some black dust remains in the profile and can be expected to bleed up into the first coat of the new coating.

Coal tar epoxy is radically different than coal tar enamel. Developed in the 1960s, coal tar epoxy was first specified as SSPC Paint 16-68T in 1968. The coating is essentially a quite thick epoxy. Specifications typically call for a minimum of 16 mils and thicknesses in the 20- to 25-mil range are very common. Abrasive blasting is very effective method for removal, using a grit size the same as one would for any other hard coating of this thickness. UHP water jetting is also effective, but impact tools are not logical for most large jobs.

Coal tar, whether used in coal tar enamel, coal tar epoxy, or any other coal tar-based product, does pose some unusual safety issues. It is manufactured by the high temperature distillation of an organic material (coal), which results in the formation of a host of chemicals, some of which are carcinogenic. These are the same chemicals that are generated when tobacco is burned or a steak is grilled on the back yard Bar-B-Que. These chemicals do irritate the skin and pose a risk of cancer if they are inhaled. Abrasive blasters and others working in the area should wear appropriate respiratory protection and keep their skin covered as much as possible.

Editor's Note: Problem Solving Forum (PSF) questions are posted on the free daily electronic newsletter, PaintSquare News (PSN), on behalf of *JPCL*. Responses submitted through PSN and those sent to *JPCL* are selected and edited to conform to *JPCL* style. Send questions and answers to kkapsanis@protectivecoatings.com.

SSPC Protective Coatings Specialist


Cindy O'Malley

Q&A with Cindy O'Malley, By Jodi Temyer, JPCL

This month's SSPC-certified Protective Coatings Specialist is Cindy O'Malley, Laboratory Services Manager for KTA-Tator, Inc.

O'Malley directs efforts for coatings research, coating failure investigations, and coatings testing services. She is a member of SSPC, the American Chemical Society, American Society for Testing and Materials (ASTM), and the American Coatings Association. O'Malley holds a BS from Pennsylvania State University.

JPCL: How did you become interested in working in the protective coatings industry?

Cindy O'Malley: I began work in the protective coatings field first at KTA in the position of Quality Assurance Coordinator for the laboratory. I progressed from that position to Laboratory Services Manager over a five-year period of analyzing coatings and performing coating failure analysis. Total immersion in the field of protective coatings and working with numerous manufacturers, formulators, specifiers, owners, contractors, inspectors, researchers, and architects resulted in a dynamic position in the industry and, therefore, was quite engaging and interesting. I'm now in my 17th year in the industry.

JPCL: Your position as Laboratory Services Manager has a wide range of responsibilities. What part is the most rewarding to you?

CO: Working with others finding solutions to the most complex problems.

JPCL: Out of the hundreds of coating failure analysis projects that you've worked on, have any of the causes of failure truly surprised you?

CO: Absolutely. One of the many reasons that I enjoy forensic analyses is that understanding the causes of coating failure results from an investigation. Understanding the information as discovered allows you to get to that eureka moment…for the majority of projects. The more experience you gain, the more eureka moments because you better understand the data obtained as well as the applicability of that information.

JPCL: Last year, you presented on Women in the Coatings Industry at the SSPC show. At this year's conference you will be following up on survey responses about the role of women in the industry. How do you think the role of women has changed since you first started in the industry?

Cindy O'Malley speaking at SSPC 2011 in Las Vegas. Photo courtesy of SSPC.

CO: I believe women have more opportunities than ever before in the industry. The coatings industry is historically male dominated; however, reducing the gender gap as women obtain leadership positions in coating industry organizations has begun to influence culture. The benefits of a culture shift were not yet understood when I started in the industry. Programs such as SSPC's Women in Coatings at the National Conference are necessary to appropriately recognize women's significant contributions.

JPCL: What advice would you give to women considering a career in industrial coatings?

CO: A career in coatings, not limited to industrial coatings, can be very rewarding for several reasons. Coatings are diverse which means that opportunities are diverse. There appears to be something for everyone, and more importantly, the diversity benefits advancement in the industry in technology, culture, and global considerations.

JPCL: What woman in this industry has most impressed you over the years and why?

CO: Several women in the industry that I am equally impressed with for their intelligence, skilled communication, and leadership include Joyce Wright, Northrop Grumman Newport News Shipbuilding; Elizabeth Haslbeck, NAVSEA; and Sharon Feng, Bayer MaterialScience.

JPCL: When you get time to yourself, how do you like to spend it?

CO: I'm not sure if time to myself equates to family time, but my time with my husband and my kids is always a gift, and I am very fortunate to have a wonderful family. Time to myself in the literal sense equates to running. I love every aspect of running outdoors.

JPCL: Describe your dream vacation.

CO: Ireland with my husband and three weeks minimum to explore.

JPCL: What's the best advice anyone has ever given you?

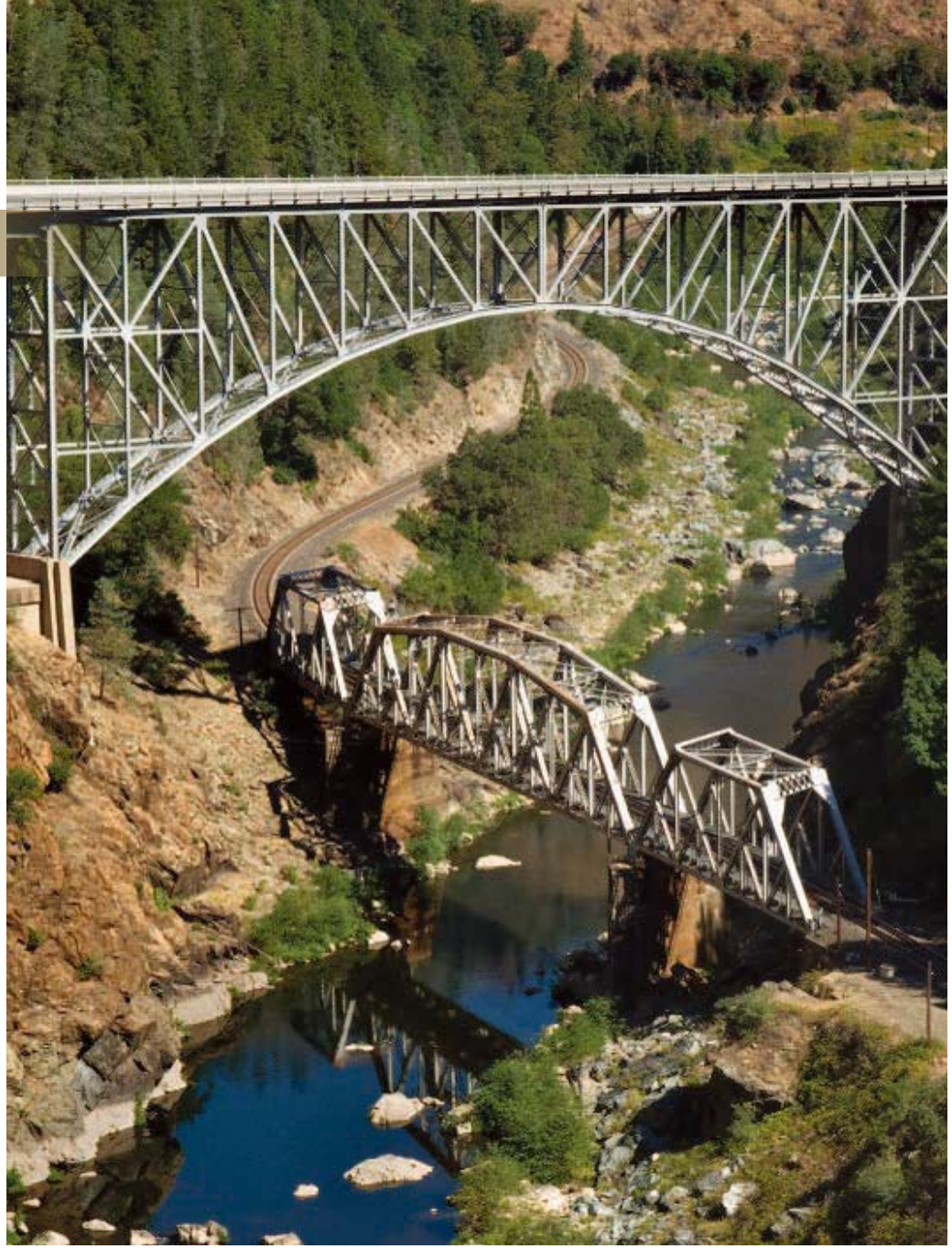
CO: You don't have to figure out who you are to be successful, happy, or content. You become who you are by the choices you make and can become who you want to be starting with your next choice.

JPCL: The worst advice?

CO: Someone once told me that it is necessary to maintain focus on accumulating wealth or you may never have enough of it. I believe that person sees life completely differently than me. I believe if you are not careful, life is the moments missed while focused on accumulating wealth.

JPCL

Cases from the F-Files



Courtesy of iStockphoto

The Case of … One Too Many Choices

Eric S. Kline, KTA-Tator, Inc.
Richard A. Burgess, Series Technical Editor

This is the story of a steel bridge in the northeastern U.S., but it could be true of a bridge anywhere in the U.S. The structure, although nearly 50 years old, was sturdy and still within its design life. The State Department of Transportation (DOT) District maintenance engineers, during review and planning, determined there was no need to consider demolition and replacement of the bridge. However, it was determined that a deck overlay replacement should be part of the bridge deck maintenance program. The DOT wanted to address the paint system as part of the same contract letting.

The paint condition was judged to be "fair to good" during the most recent biennial inspection. Some coating breakdown was noted around the bolted splices, but on the balance of

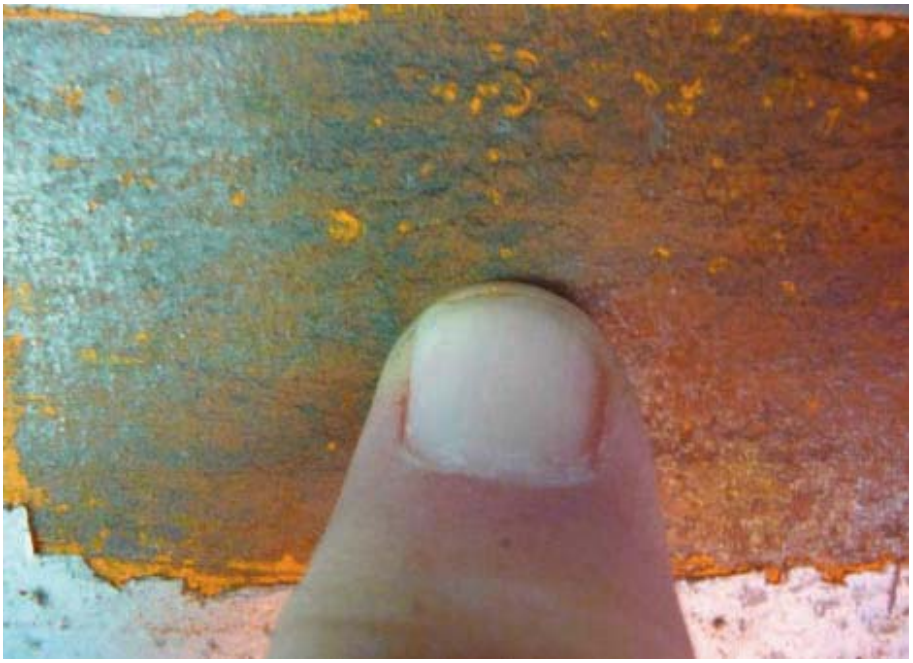


Fig. 1: Mill scale on the substrate beneath the lead-alkyd coating system. Photos courtesy of KTA-Tator, Inc.

Fig. 2: The left side of the angle shows old primer; the right side does not.

the structure, the coating appeared to be in satisfactory condition. With the bridge having been constructed in the 1960s, there was little doubt that the original coating system consisted of a multi-layer lead alkyd system, likely applied directly over mill scale. The agency knew that it was a matter of time before the coating system would require maintenance. Performing maintenance painting during deck replacement work seemed like a logical progression.

This article describes the painting project from the invitation to the bid and coating completion to the analysis of peeling and disbondment two years later (e.g., Figs. 1–3). The events that unfolded as described below illustrate how a few simple tests before preparing a bid package can save an agency both time, money, and public image.

The Invitation for Bids

Funding for maintenance operations was tight, as is usually the case with State agencies. Nonetheless, the State decided to advertise the deck replacement and elected to include two alternate bidding scenarios for maintenance painting.

Option 1

The first option contained the following for the maintenance painting requirements.

- "Replace the deck and completely remove the coating and prepare the surface in accordance with SSPC-SP 6 "Commercial Blast Cleaning."
- "Apply a traditional DOT-approved maintenance coating system consisting of an epoxy mastic primer/midcoat with a polyurethane topcoat."

It should be noted that according to SSPC-SP 6, "all visible oil, grease, dust, dirt, rust, mill scale, coating, oxides, corrosion products, and other foreign matter" must be removed.

Option 2

Maintenance painting requirements in Option

Fig. 3: The rougher coating on the upper left side was thicker, and the old coating system was present. The lower right side had only the new overcoat system. Old coating edges lifted.

2 were similar to Option 1; "Replace the deck…" but included an overcoating option for maintenance painting.

- "Prepare the surfaces for painting in accordance with SSPC-SP 7, "Brush-Off Blast Cleaning."
- "Apply an epoxy mastic primer and a polyurethane topcoat."

In contrast to SSPC-SP 6, SSPC-SP 7 requires that only loose paint, loose rust, and loose mill scale be removed. (Tightly adherent paint, rust, and mill scale are allowed to remain.) Because the State intended that the majority of the existing system would remain, there was no need for two coats of epoxy.

The Bid Opening

During contract bidding, three companies submitted proposals.

- Bidder A proposed to provide Option 1 for $100,000 and Option 2 for $100,000.
- Bidder B proposed to provide Option 1 for $150,000 and Option 2 for $125,000.
- Bidder C proposed to provide Option 1 for $200,000 and Option 2 for $200,000.

The DOT interviewed the low bidder, Bidder A, to ascertain whether his bid had been submitted in error. Bidder A responded that he was confident that his bid had been prepared correctly. Accordingly, a contract was subsequently awarded to Bidder A, hereafter referred to as Contractor A.

At the Jobsite

Contractor A chose to exercise Option 2 (SSPC-SP 7, Brush-Off Blast Cleaning and overcoating). His logic in bidding both options for the same price was that most of his costs in the project lay in mobilization and the environmental, health, and safety costs (including containment) associated with the existing lead-based system. After these costs were incurred, the main difference in cost between Option 1 and Option 2 was the comparative effort in preparing the surface of the steel to achieve an SSPC-SP 6, Commercial Blast, as well as to apply a three-coat system, instead of the less rigorous SSPC-SP 7, Brush-Off Blast followed by application of a two-coat system.

Contractor A chose Option 2 because by his calculation, Option 2 would require significantly less labor and material (abrasive and coatings), thereby increasing his margin on the project. During the ensuing construction season, work proceeded accordingly. The contractor mobilized, prepared the steel surface according to the requirements of SSPC-SP 7, and applied the approved two-coat epoxy mastic-polyurethane coating system.

The Aftermath

Within two years of the maintenance work, DOT maintenance personnel observed minor peeling of the coating on corners, edges, and connections. Projecting that the peeling and disbonding problem would worsen and become more widespread, the Agency contracted with a coatings consulting firm to independently investigate the cause of the localized coating disbondment.

The investigation revealed that while some small areas exhibited disbonding, the coating system was generally performing as expected, and the majority of the coated structure did not show signs of premature failure. Further, it was noted that the coating

system in the failing and non-failing areas had been applied within the specified thickness limits of 6 to 10 mils (4-6 mils of epoxy mastic and 2-4 mils of polyurethane). The coating and the surface beneath the coating in the failing areas were closely examined. The failing coating was peeling from the steel substrate and found to include the new paint layers as well as portions of the old coating system. The steel surface beneath the coating in the failing areas contained a fairly intact layer of mill scale (Fig. 1, p. 18). Adjacent areas where non-failing (intact) coating was present found thicker films (typically 20 mils) that included the old coating system and thinner areas (typically 9 mils) where only the new coating system was present (Fig. 2, p. 18 and Fig. 3, p. 20). The substrate beneath the non-failing coating still contained mill scale, but the mill scale where the old coating was absent appeared to have been abraded (Fig. 4, p. 23 and Fig. 5, p. 24) while the mill scale beneath the intact old coating was not abraded. The total thickness of where the old coating system remained was measured non-destructively and found to range from 14 to 42 mils with an average of 22 mils.

Fig. 4: The substrate beneath the new overcoat system contained a roughened mill scale surface.

Adhesion testing (per ASTM D3359, "Standard Method for Measuring Adhesion by Tape Test," Method B (cross-cut) resulted in a rating of 0B (Fig. 6) before the tape could be applied. Method A (X-cut) revealed 0A-1A adhesion ratings, with the location of break primarily between the mill scale surface and the overcoated existing aged lead alkyd system. Although the new coating system applied directly to the roughened mill scale exhibited better adhesion ratings, (3A or better) they represented only a small portion of the painted surface.

Samples of the failing and non-failing coating materials obtained during the field investigation were returned to the laborato-

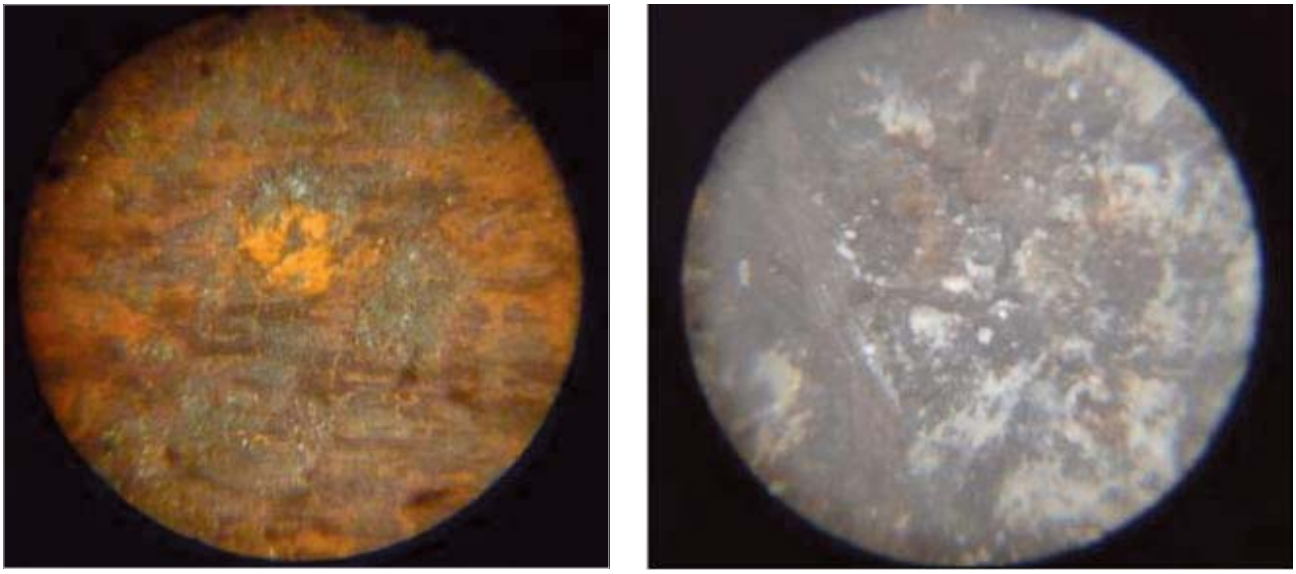


Fig. 5: (left) A magnified view of the substrate beneath the old coating system; (right) a magnified view of the substrate where only the new coating system was present.

ry. Control samples of the same batch of coating materials were obtained directly from the coating manufacturer. Spectra obtained using Fourier transform infrared spectroscopic analysis (FTIR) of properly mixed samples were compared to samples removed from the field in both failing and non-failing areas. The comparison revealed that coatings applied to the structure by Contractor A were a generic match to the materials specified, and there was no evidence of mis-mixing or adulteration of the coatings. Cross-sectional coating thickness measurements confirmed the measurements obtained in the field.

Discussion and Conclusion

There are a number of factors to consider in this project. First, the Agency offered two cleaning and painting options and allowed the contractor to make his choice between those options. One should anticipate that the contractor would choose the option that would expend the least amount of labor and materials and thereby improve the profit margin on that job. If the owner had retained the right to select the maintenance painting option, there is little doubt that he would have chosen Option 1, removal and replacement of the coating system, over Option 2,

Fig. 6: An ASTM D3359 Method B (Cross-cut) Tape Test resulted in a 0B rating even before the tape could be applied.

overcoating. The fact was that with no difference in price, the Option 1 requirement to replace the aged system would have afforded the DOT with longer term corrosion protection to the bridge and would have been the chosen Option.

Secondly, before providing the bidders with the option for overcoating the existing aged alkyd system, the owner should have considered and investigated whether there was risk inherent in applying a new coating system over the old coating, irrespective of the degree of surface preparation of the steel beneath the old system.

The post-project investigation determined that the coatings applied were those specified, that they were mixed and applied to the correct thickness, and that even in the failing areas, there was some evidence of abrasive impingement of the mill scale covered surface. Thus, it would appear that Contractor A complied with the coating specifications for Option 2.

In hindsight, the DOT learned that the SSPC Overcoating Guide (SSPC-TU 3 "Overcoating," May 1, 1997, Editorial Revisions November 1, 2004) should have been consulted before allowing and accepting bids for the overcoating option (Option 2).

In Appendix A.2.1 Bridge Painting Use Risk Table of SSPC-TU 3, an example for a simple bridge painting project is developed. The procedures outlined include a method by which several factors including rusting, coating adhesion, and coating thickness are combined in deciding on the overcoating strategy to bridge painting. Because rusting of the steel was minimal on this project

Table 1: Risk of Salvaging Existing Coating Based on Adhesion/Thickness Characteristics**

Adhesion Classification			Coating Thickness		
ASTM D 3359 Method B* (using 5 mm guide)	Percentage Removed	ASTM D 3359 Method A	< 10 mils (< 254 µm)	10-20 mils (254-508 µm)	> 20 mils (> 508 µm)
5B	0%	5A	OK	OK	OK
4B	1% to 5%	4A	OK	OK	OK
3B	6% to 15%	3A	OK	OK	OK
2B	16% to 35%	2A	LR	LR	MR
1B	36% to 65%	1A	MR	HR	HR
0B	> 65%	0A	NO	NO	NO

OK = essentially no risk | LR = low risk | MR = moderate risk | HR = high risk | NO = integrity too poor to salvage

* Method B is not recommended for use on films above 5 mils in thickness unless otherwise agreed upon between the contracting parties.

***Reprinted from SSPC Technology Update No. 3 (SSPC-TU 3), Overcoating*

(less than 3% general rust in localized areas and less than 0.3% overall), it was only necessary that the adhesion and the thickness of the existing coating (discussed above) be assessed and measured. Table 1, "Risk of Salvaging Existing Coating Based on Adhesion/Thickness Characteristics" is based on these two factors.

The table indicates that when coating adhesion is rated 2B/2A or less (per ASTM D3359 "Standard Method for Measuring Adhesion by Tape Test"), the risk of a disbonding-type failure increases. Further, as the coating thickness increases, the risk of disbonding-type failure also increases.

Option 2 allowed Contractor A to apply an additional 6-10 mils (150 to 250 µm) of coating to be applied over an existing, old alkyd coating system that was applied to mill scale. The curing stresses imparted by the two additional coating layers coupled with a poorly adhered existing brittle coating system (further weakened by brush-off blasting, which can cause microcracking in the existing system) resulted in the localized disbonding observed. The Agency was correct in anticipating that, over time, the disbonding would become more widespread with the addition of thermal stresses caused by weather patterns. The adhesion failures evi-

dent on this bridge structure could have been anticipated, leaving only one option—complete removal and replacement of the aged coating system.

Repairing the Disbonding Coating

In a case such as this one, the repair options for the owner are somewhat limited. The owner would not appear to have any recourse with the coating applicator because the contractor completed the contract as required. The owner could elect to leave the coating "as is" and touch up the small areas that are disbonding, or he could elect to advertise the project, this time including only one option: removal and replacement of the aged lead alkyd system and the newer (two-year old) epoxy/polyurethane system. In this case, the owner elected have the Agency's own maintenance crew touch-up the failing areas and, in so doing, elected to defer total coating removal and replacement into the future.

Ironically, if the bids had been received as indicated earlier and the owner had retained the choice of option (and had conducted an assessment of risk based on the physical condition of the existing coating), all of the old paint and mill scale could have been removed and a new coating system installed at no escalation of cost.

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Mr. Kline has presented lectures on coatings, specifications, surface preparation, paint application, and failure analysis for numerous KTA clients and educational institutions. He has been involved in the coating, both shop and field, of virtually every type of industrial structure. Mr. Kline is a member of SSPC: The Society for Protective Coatings (chairman, co-chairman, or past chairman of many SSPC committees), NACE International, Polyurea Development Association, and American Railway Engineering and Maintenance of Way (AREMA). He has served on the Executive Committee of the International Bridge Conference and has served in a leadership capacity at the PACE National Conferences.
JPCL

Case History

Fig. 1: General view of the Dunmore Bridge. Photos courtesy of the author.

The Dunmore Bridge:

Challenges in Working on a Rare and Historic Bridge

By Mike Rooney,
Contract Resources Pty Ltd

Fig. 2: Lift towers.

Originally completed in 1899, the Dunmore Bridge is an example of an Allan truss road bridge and is one of three surviving overhead braced timber truss road bridges in NSW, Australia (Fig. 1). The bridge also has a lift span to allow river traffic under it (Fig. 2), which is a rare feature that offers much technical significance and information about the engineering technology of the late 19th century. Most of its engineering details are intact, and the bridge is in good condition. The bridge is owned by Roads & Maritime Services (known as Roads & Traffic Authority NSW at the time of the project).

The main spans of the superstructure are supported by twin cast iron cylinder piers (Fig. 3). The bridge provides a single-lane carriage way with a minimum width of 4.3 m and a footpath. An Armco guardrail protects vehicular traffic, and a timber post and rail fence are provided on the footpath. The lifting mechanism is no longer in service since the lifting ropes and counter weights were removed.

The Dunmore Bridge is located in the Hunter region, which has 15 historic bridges that were constructed before 1905. Its proximity to the high concentration of other historic bridges in the area is significant to its heritage. The people who live in the area around the bridge (the Woodville and Hunter regions) value the bridge highly, and as such

Fig. 3: Finished twin cast iron cylinder piers.

Fig. 4: Flooding occurred during the first week of the project.

it has social significance.

In 1998, there were 38 surviving Allan trusses of the 105 built in NSW, and 82 timber truss road bridges survive from the over 400 built in Australia. The Dunmore Bridge is a rare and representative example of Allan timber truss road bridges and is assessed as being nationally significant, primarily because of its technical and historical significance.

Timber truss bridges were preferred by the Public Works Department from the mid-19th to the early 20th century because they were relatively cheap to construct and used mostly local materials. The financially troubled governments of the day pressured the Public Works Department to produce as much road and bridge work for as little cost as possible, using local materials. This effectively prohibited the use of iron and steel, as these, prior to the construction of the steel works at Newcastle in the early 20th century, had to be imported from England.

Allan trusses were the first scientifically engineered timber truss bridges and incorporated American design ideas for the first time. This is a reflection of the changing mindset of the NSW people, who were slowly accepting that American ideas could be as good as or better than European ones. The high quality and low cost of the Allan truss design entrenched the dominance of timber truss bridges for NSW roads for the next 30 years.

Scope of Work

The project was started in April 2009 and completed in July 2009. The scope of work to be performed included scaffolding, encapsulation, removal of lead coatings, repainting of the steel lift span and cast iron piers, minor steel repairs, and traffic and environmental management. No work was carried out on the timber truss spans.

This project presented real challenges to Contract Resources before work could even commence on blasting and painting. The road had to remain open for the duration of the project; there were severe limitations on wind and weight loadings; the bridge is extremely narrow, which meant that there was limited clearance from the inner face of the scaffold to the lattice columns; and the river is used for recreation and transportation.

Record rains and subsequent flooding

Facing Page: Fig. 5: Through view of scaffolding.

Fig. 6: Shrinkwrap containment of bridge section.

Fig. 7: Riveted and coated cast iron pier.

washed away the site compound on the first week of the project, resulting in total reestablishment of the site on higher ground (Fig. 4, p. 29).

The initial challenge was in the scaffolding and containment installation. The scaffold on the superstructure was not to be tied to the actual bridge structure, and the containment had to withstand wind loads of 150 km/hr.

Custom-designed "soldiers" were attached to the crash rails and braced back to the lower truss, which allowed the complete scaffold to be freestanding and meet design criteria. The scaffold was then contained in defined sections using shrink wrap to effectively seal the work area before abrasive blasting and painting (Figs. 5,6).

These restrictions on loadings presented further challenges when accessing the piers. Engineered ladder beams were used to allow the scaffold to hang without compromising the structural integrity of the wooden trusses.

The blasters and painters had to work in limited space to treat the lattice-type columns, which were only 900 sq mm and had to be blasted inside and out. Free space between the column face and roadside scaffolding was only 450 mm.

Spent abrasive had to be vacuumed every two hours to make sure no overloading of the structure occurred.

The surface preparation and coating application was closely monitored by the RMS (formerly RTA) and its consultant to ensure the new coatings provided a long life expectancy.

The coating system on the lift tower was comprised of a prime coat of polyamide-cured, zinc-rich epoxy at 75 microns; two coats of high-solids, high-build MIO epoxy at 125 microns each coat; and a finish coat of 75 microns of acrylic-modified, MIO-pigmented, two-pack polyurethane with stripe coating of edges, rivets, and laps with each coat. The cast iron piers were coated with two coats of UHB epoxy at 125 microns per coat (Fig. 7).

Acknowledgments

AkzoNobel supplied the coating material. The contractor/applicator was Contract Resources Pty Ltd. A regional bridge engineer and an additional project manager were provided by the structure owner, RMS (RTA NSW at the time of the project). KTA-Tator, Inc. provided a client consultant. ScaffRite Industrial Scaffolding managed the scaffolding work.

The author would like to thank Roads & Maritime Services (RMS) for providing historical background information on the bridge. JPCL

Concrete Maintenance

Maintain to Sustain

By Fred Goodwin, BASF Corp.
Construction Chemicals

Fig. 1: The Pantheon in Rome, one of the oldest existing concrete structures built in 126 AD. The dome is of non-reinforced natural cement. iStock photos

Editor's Note: Fred Goodwin is one of 24 recipients of *JPCL*'s 2012 Top Thinkers: The Clive Hare Honors, given for significant contributions to the protective coatings industry over the past decade. The award is named for Clive Hare, a 20-year contributor to *JPCL* who shared his encyclopedic knowledge of coatings in many forums. Mr. Goodwin's article is the first in a series of original articles by award winners that will appear in these pages throughout the year. Professional profiles of all of the award winners, as well as an article by Clive Hare, will appear in a special 13th issue of *JPCL*, to be published in August 2012.

Concrete is the most widely used building material in the world because of its cost, versatility, and durability. It is inherently resistant to fire, floods, and attack by vermin such as insects or rodents. Concrete is made from a combination of hydraulic cement, aggregate, water, and sometimes admixtures. Adjectives for concrete imply its outstanding performance: solid, substantial, firm, indurate, monolithic, strong, and unyielding.

The maintenance of concrete is nearly an oxymoron—we perceive concrete as such a durable material that we skip the maintenance and wait until repair is necessary. We do not skip maintenance for our cars—it is easy to imagine the consequences of not changing the oil or keeping the tires inflated. For other structural materials of construction we are sufficiently concerned about durability that we plan to paint or otherwise protect them to avoid the consequences of neglect. With concrete, we tend to ignore it until spalls, cracks, or rust stains from reinforcing appear. This article discusses the durability of concrete, factors affecting durability and concrete sustainability, and the need for maintenance.

Concrete Durability

Concrete can be an extremely durable material. The oldest concrete to date is from a floor over 9000 years old.[1] Other ancient structures are suspected to have been built with concrete, such as the reported use by the Egyptians as early as 3000 BC,[2] the construction of the Pantheon in 126 AD,[3] and other ancient structures that still exist today (Fig. 1). Unfortunately, these structures are the exceptions compared to the majority of concrete structures.

Modern concrete began with the invention of portland cement by Aspdin in 1824[4] and the introduction of steel reinforcement in 1849 by Monier.[5] Early portland cement was a coarsely ground, relatively slow-setting material that developed strength slowly compared to the material by the same name produced today. Modern portland cement is more finely ground and chemically optimized for strength development, which is beneficial for rapid construction techniques; however, the modern version also has higher shrinkage and is therefore more prone to cracking than earlier Portland cement. Through a properly planned and implemented maintenance program, a significant extention of the durability of concrete can become much more likely.

The 3 D's Causing Concrete Durability Issues

Design and Construction

The key to maintaining a concrete structure is to never allow the concrete to reach a point requiring repair. Design and construction, deterioration, and damage (the 3 D's) all compound (just like interest on a loan) to require repair. Some estimates of the root cause for less than satisfactory concrete performance place up to 50% of the blame on design and construction errors.[6] Simple design matters such as selection of the proper mix design for the exposure environment, adequate cover over reinforcing steel, curing of the concrete, and attention to details such as drainage are critical to the durability of the concrete (Fig. 2). Mistakes in any of the design elements create "weaknesses" in the concrete that manifest themselves as areas susceptible to deterioration.

The design defects become even more significant from errors or inaccuracies occurring during construction, such as the addition of extra water to concrete for ease of placement, movement of reinforcing or formwork during concrete placement, or lack of consolidation of the concrete. Quality control and assurance are frequently neglected from overconfidence in experience ("I've been doing this for 20 years"), increased cost ("testing costs money and time"), the ability of concrete to hide issues until later ("if I can't see, it I can't fix it"), and the tendency to leave small matters alone ("I don't want to be the bad guy"). Without proper design and construction, the concrete structure is off to a bad start in its life cycle.

Deterioration

These construction defects become magnified through the stress of deterioration such as the

Fig. 2: Reinforcing steel induced concrete spalling likely due to high permeability concrete rapidly carbonating causing corrosion of the imbedded steel.

Fig. 3: Deterioration of concrete steps from environmental attack such as acid exposure and deicer scaling. Figs. 2, 3, and 4 courtesy of BASF

wear and tear of use, temperature changes, weathering, ingress of deleterious materials, and the other basic forces of entropy (Fig. 3). There is a saying that there are two types of concrete, cracked and going to crack,[7] which is why joints in concrete were invented. Cracking occurs because the tensile strength of concrete is usually only about 10% of its compressive strength.[8] Once concrete cracks, all other durability properties become compromised.

Continuing movement of cracks frequently causes problems with coatings, toppings, or overlays remaining as barriers to protect the underlying concrete. Cracks in structures subjected to traffic can rapidly deteriorate the adjacent concrete because of point loading of the crack edges as well as D-cracking in freezing environments. Point loading of crack edges occurs as traffic places force on the edge of the crack to concentrate the impact on a localized area effectively crushing the corner to cause the edge of the crack to ravel away and widen the top of the original crack.[9] D-cracking occurs on exposed edges of cracks and joints where moisture can saturate the concrete from both the horizontal and vertical surface that in freezing environments cause accelerated freezing and thawing cycle distress.[10] Cracks also look bad and are the most frequent subject of complaints about concrete, particularly architectural concrete. More importantly, large external cracks, interlinking with internal voids and micro cracks always present in concrete, make it possible for water, harmful chemicals, and gases to penetrate, with relative ease, to the interior of the concrete mass. This phenomenon is likely the most common cause of numerous concrete durability problems with field structures.

Cracking

Cracking of cementitious materials like concrete can be described as plastic shrinkage cracking, thermal cracking, or drying shrinkage cracking. These terms describe the age at which cracking was first noticed, with plastic shrinkage occurring during the first few hours after placement.

Plastic shrinkage cracking is usually caused by the loss of moisture from the material from evaporation and absorption before the concrete or mortar has developed any appreciable cohesive strength and is a construction defect. Plastic shrinkage cracks can be minimized by preventing this loss of water through techniques such as dampening the sub-base, curing,[11] use of water retention agents, and using fine fibers to increase the tensile strength of the material.

Thermal cracking results from differences in temperature within the cementitious material and possibly the surrounding environment. As cement hydrates, some heat is generated, causing expansion. In massive placements, the heat of hydration can create substantial temperature differences between the outside of the concrete and the interior where heat is trapped; the temperature differences can be sufficient can cause cracking. Use of high early strength materials can exacerbate this problem. Another type of thermal cracking occurs between dissimilar materials after hardening. In such cases, differences in the coefficient of thermal expansion between the concrete and other materials can cause sufficient stress

Fig. 4: Reinforcing steel corrosion (likely chloride induced) causing section loss on a concrete bridge beam.

to create delamination at the materials' interface.

Drying shrinkage cracking results from loss of water from the hardened cementitious material. The amount of water to completely hydrate cement has been estimated from 18 to 22% by weight of the cement; however, mixes of this low water content are impossible to mix and consolidate, even with high admixture dosages. Extra water is always present, and the evaporation of this water results is a volume change corresponding to as much as 0.15% in some repair materials.[12] Repair materials are applied to concrete that has already undergone most of its shrinkage, so the shrinkage that occurs is restrained by the bonding of the repair material to the substrate concrete. The amount and rate of drying shrinkage are strongly influenced by the temperature, relative humidity, surface-to-volume ratio of the specimen, cementitious components content, and water-to-cementitious content ratio. Other influences such as cement fineness, cement alkali content, and quantity and type admixtures used have also been documented.

Corrosion

One of the most significant deterioration factors of concrete is from the corrosion of reinforcing steel (Fig. 4). The cost of corrosion of reinforcement in concrete is estimated to be in excess of $125 billion per year.[13] Reinforcement is added to concrete to increase its tensile properties and is ordinarily protected from corrosion by the passivation caused by the high pH when embedded in concrete. Reinforcing steel corrosion is a complicated electrochemical process and has, in concrete, three main causes.

- Aggressive ion ingress (usually chlorides)
- pH reduction in the surrounding concrete (usually from carbonation)
- Stray current-induced corrosion

All of these causes of corrosion of reinforcing steel require moisture in the concrete. When concrete cracks, deterioration due to reinforcement corrosion accelerates for three reasons: chlorides rapidly penetrate to the reinforcement, carbonation occurs adjacent to the reinforcement, and charge localization occurs where the crack tip intersects the steel. Strategies to effectively monitor corrosion tendencies, proactively address corrosion during its initiation phase, or prevent the progression of corrosion have been shown by Tuutti and DeSitter to be extremely cost effective compared to waiting for visible signs of corrosion to indicate a problem (Figs. 5–7).[14]

Damage

The severity of damage (incidents occurring as unexpected sudden events such as fire, earthquake, impact, etc.) is compounded by the existing weakness from deterioration and design/construction deficiencies. Once concrete is damaged or deteriorated to the extent that the use of the structure is impaired, concrete requires repair. Unfortunately, repairs have a relatively poor performance record. In at least two systematic studies,[15,16] the same conclusion was reached: Only about 50% of the repairs performed are satisfactory. Repair of concrete is not the solution to sustainability.

Concrete and Sustainability

Sustainability is often described as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."[17] Because concrete forms such a large portion of our infrastructure,

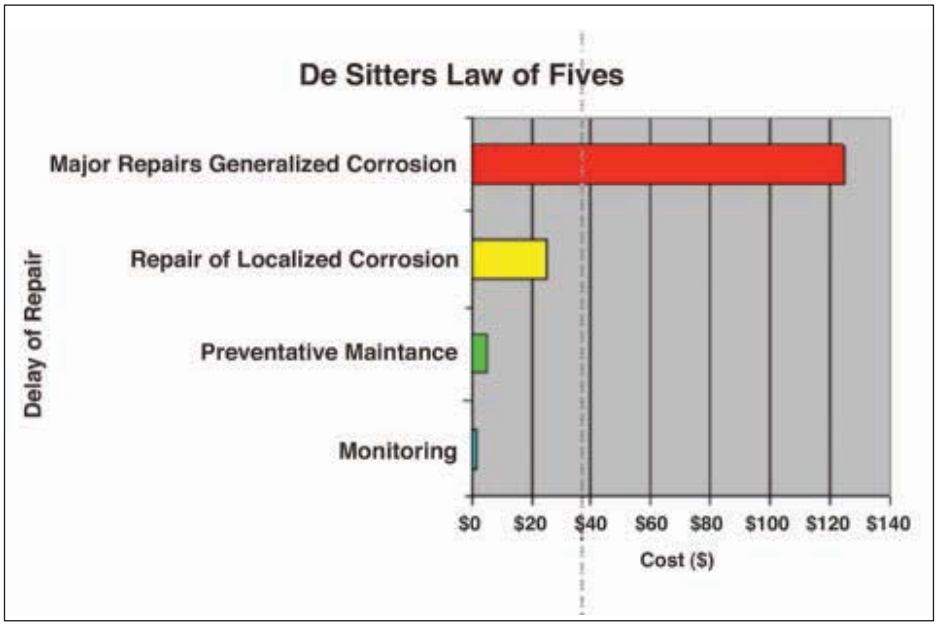

Fig. 5: Diagram based on Desitter's Law of Fives showing increasing cost of repairs from Proactive Monitoring based at $1 through Preventative Maintenance at 5X, Repair following Localized Corrosion at 25X, and Major Repairs Following Development of Generalized Corrosion at $125X.

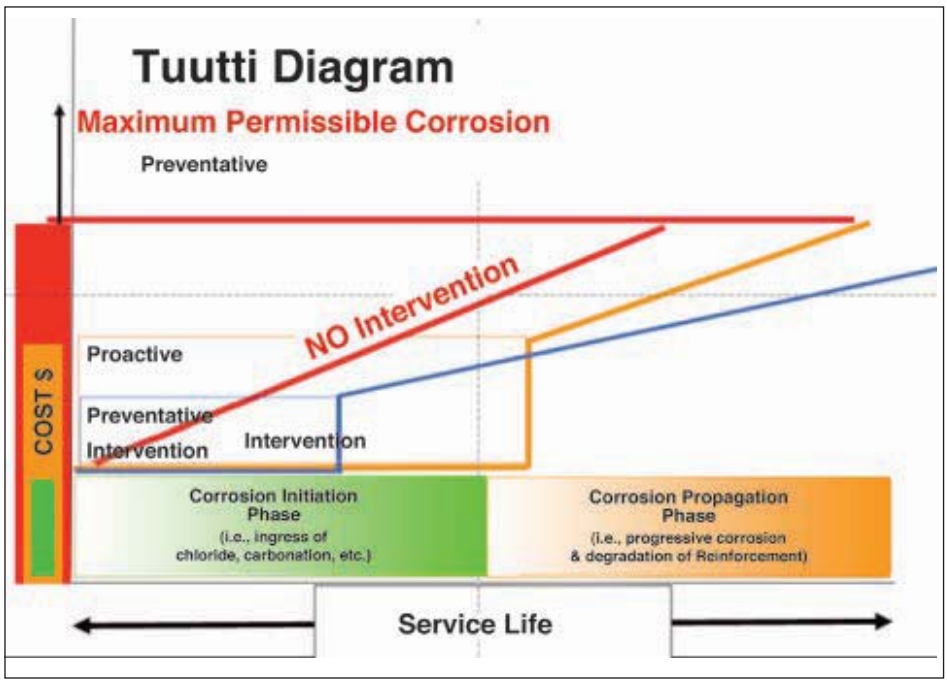

Fig. 6: Diagram according to Tuutti showing increased cost of mitigation of corrosion damage and reduced service life for preventative, proactive, reactive interventions compared to lack of intervention.

buildings, and surroundings, maintaining durable concrete is certainly an important part of having a sustainable society.

Economic Sustainability

The creation of the built environment in the United States accounts for 7 to 10% of all economic activity, consumes 40% of extracted resources,[18] and consumes 30 to 40% of generated energy in most industrial countries including the United States.[19] Cement production is the largest contributor to emissions and energy consumption in concrete products, accounting for an estimated 2% of global primary energy and 5–7% of global CO_2 emissions. In other words, concrete as a construction material produces significant environmental impacts. Longer use of a concrete structure through maintenance improves the value for this investment of resources.

Environmental Sustainability

The operation of buildings is currently responsible for about 40% of national annual energy usage and about 70% of national electricity consumption.[20] The greenhouse gas emissions due to operation energy of buildings are typically responsible for 88%-98% of life cycle emissions. Compared to wood or steel structures, concrete buildings typically have equal or higher embodied emissions, but have lower operating emissions. Emissions from concrete structures can lead to life cycle emissions similar, over time, to those from wood or steel structures. However, the benefits of concrete construction become clearly evident for all types of studied structures (single family residential, multi-occupant, and commercial made of steel, wood, and concrete) over projected lifetimes of at least 60 years.[21] Extending the life cycle of concrete structures through maintenance therefore further improves on energy usage compared to other types of construction materials. Through design optimized for energy usage, even more advantages of concrete construction become apparent.[22,23,24]

As of 2010, the total U.S. building stock

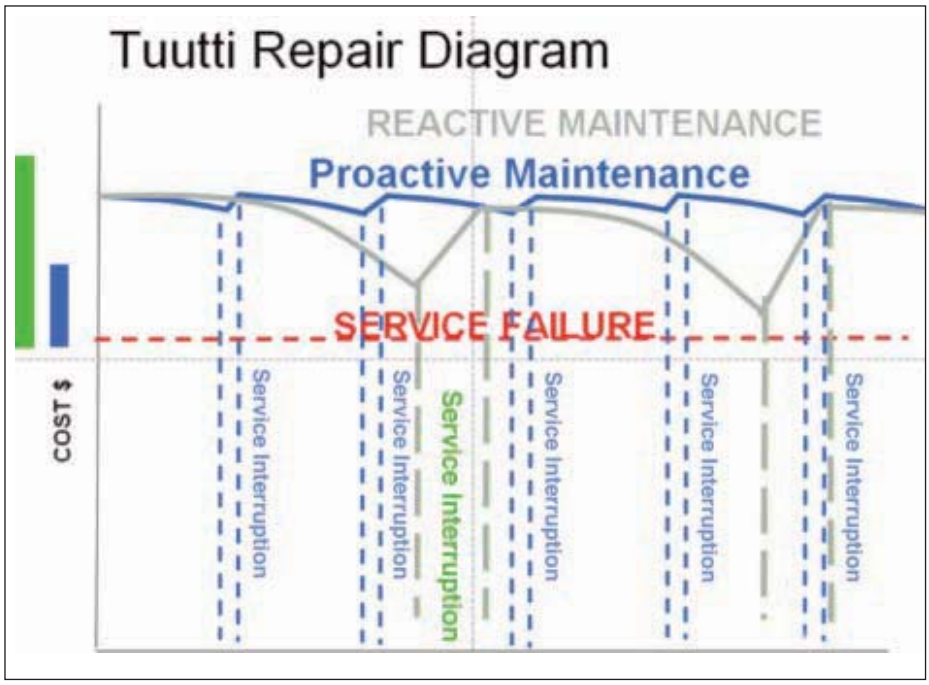

Fig. 7: Diagram based on Tuutti showing benefits of comparatively frequent short maintenance repairs compared to longer and less frequent repairs. The total cost of the more frequent preventative maintenance repairs as well as the cumulative service interruption time is usually significantly less than deferring maintenance of concrete structures.

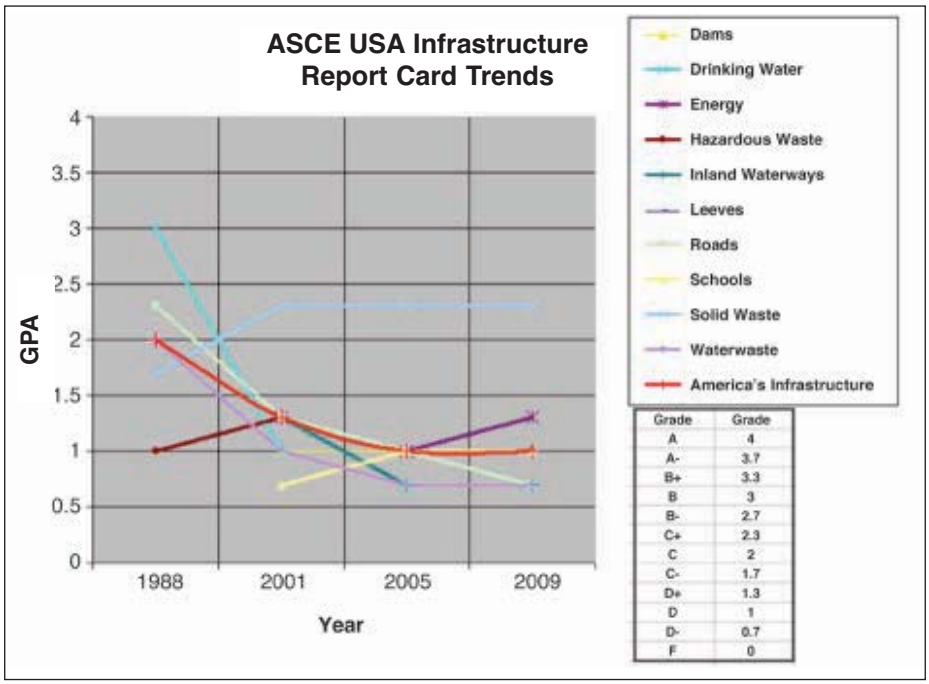

Fig. 8: Graph of grades awarded US infrastructure by the ASCE Report Card based on 1988 having a Grade C (GPS 2). The trends are generally downward.

was estimated to be approximately 275 billion square feet. During normal economic times, we tear down approximately 1.75 billion square feet of buildings each year (~0.6%). Every year, we renovate approximately 5 billion square feet (~1.8%). If these trends continue, by the year 2035, approximately three-quarters (75%) of the current built environment will be either new or renovated.[25] As much as 44% of the construction and demolition waste stream is attributed to renovation.[26] In developed countries, construction waste contributes from 13 to 29% of all landfilled solid waste.[27] The energy required for demolition of concrete construction is also significantly greater than for wood (5x) or steel (16X) construction.[28] Therefore, extending the lifetime of a concrete structure delays demolition and avoids the associated environmental impacts (assuming roughly the same amount of energy is required for demolition regardless of age).

Social Sustainability

The state of existing concrete structures is less than desirable. Estimates of repairs and traffic interruptions amount to a loss to the economy of $145 billion/year for highways alone. Repaired concrete tends to deteriorate faster than a well maintained structure of the same age that did not require repair. The American Society of Civil Engineers (ASCE) report card[29] captures a snapshot every few years of the estimated status and cost of restoring our infrastructure based on an acceptable condition (grade C baseline condition in 1988, using letter grades similar to those in school with A being outstanding, B superior, C average, D inferior, and F failing). The 2009 report card (Fig. 8) gives America's Infrastructure a Grade Point Average of D averaged over 15 categories and estimates that a five-year investment of $2.2 trillion is required to return to a C grade. This investment requires an expense of $7,146 per person, based on the current U.S. population.

The ASCE report card further estimates that despite a current estimated spending of $380

billion (which includes stimulus funding), a shortfall of more than $550 billion per year still occurs. Some of the statistics found in the accompanying documentation from ASCE are especially relevant to deteriorated concrete construction.

- Poor road conditions cost U.S. motorists $67 billion a year in repairs and operating costs.
- Usually built to last 50 years, the average bridge in our country is now 43 years old. According to the U.S. DOT, of the 600,905 bridges across the country as of December 2008, 72,868 (12.1%) were categorized as structurally deficient, and 89,024 (14.8%) were categorized as functionally obsolete.
- Americans spend 4.2 billion hours a year stuck in traffic, at a cost of $78.2 billion per year to the economy.
- State dam safety programs have identified more than 4000 deficient dams, with at least 1819 listed as "high hazard."
- Of the 257 locks on 12,000 miles of waterways in the USA, nearly 50 percent are functionally obsolete. By 2020 this is projected to increase to 80%.

While the statistics above indicate an urgent need for concrete repairs, they also highlight the inherent durability and robust properties of concrete. When such extensive deterioration and neglect can be allowed to continue, our future generations will pay the price for our short-term savings. Newer technologies for concrete as a construction material offer the promise of more robust construction techniques, improved durability, lower maintenance requirements, and improved repair techniques.[30,31,32,33]

Technical Complexity of Concrete

New additives and techniques are being invented almost daily,[34] and much of the effectiveness is evaluated through trial and error (speaking as an individual involved with this technology for the past 30+ years). The inability to analyze the complex interactions of water, hydraulic cement, aggregate, and admixtures keeps concrete science as more of an art than a science compared to other manufactured construction materials such as steel, glass, and aluminum. Cement is a hydrating ceramic with reactivity influenced by not only the chemical composition, but also the thermal history of the clinker (the pyroprocessed raw materials for cement prior to grinding), the particle size distribution of the cement, the variability of naturally occurring raw materials, not to mention the witches' brew of admixtures and additives. The properties of concrete change from the first seconds when water is added (10^1 seconds) though a time scale of at least decades (10^9seconds), if not longer as the cement

hydrates, a range of 8 orders of magnitude. The properties of concrete are influenced by reactions over a size scale range from the nano-scale (10^{-9} i.e., shrinkage due to pore water surface tension) to the mega-scale (10^{8}) such as the loading on a building foundation).

Summary

Despite new materials and inherent complexity, the fundamental properties of concrete will continue to make it the construction material of choice for many applications. Concrete is made from readily available raw materials, is extendable with many industrial by-products for improved performance, and is one of the few field-fabricated construction materials. Our tallest buildings,[35] longest bridges, biggest dams, and most important infrastructure will continue to be built with concrete, yet the amount of knowledge about concrete is still growing.[36,37] If we paraphrase the golden rule, then "do unto your future before your future does unto you" is true about concrete and sustainability, especially regarding maintenance.

Editor's Note: References for this article are listed on p. 46.

Fred Goodwin, a Fellow Scientist and Chemist at BASF Construction Systems, has more than 30 years of experience in the construction chemicals industry, including cement manufacture, R&D, and technical

support of grouts, adhesives, coatings, shotcrete, stucco, flooring, and concrete repair materials. Goodwin, a recipient of two *JPCL* Editors' Awards, was recently named one of 24 *JPCL* Top Thinkers: The Clive Hare Honors, an honor that recognizes a select group of the industry's thought leaders worldwide. He is an active member of SSPC and NACE and also is chairman of various ASTM, ICRI, and ACI committees. Mr. Goodwin is an inventor and holder of several U.S. Patents.

JPCL

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By Carl W. Scheffel P.E.
and H. Michael Simpson
Fox Industries

Restoring and Protecting Bridge Piles

Since the inception of bridge design, owners, engineers, architects, and contractors have been utilizing materials, methods, and systems to rehabilitate and protect bridges. Every bridge has a designed life. The life cycle may vary, depending on many factors, such as type of building material (wood, steel, concrete); climate; environment; live load and dead load; wetting and drying cycles; and chloride intrusion.

For many years deteriorated bridge piles—wood, concrete, and steel—were repaired or replaced using the same materials from which they were originally constructed. The biggest drawback for this type of repair and rehabilitation is that these materials are subjected to the same forces that caused the original deterioration. It is just a matter of time before repairs will have to be made again, and again, creating a

A completed fiberglass jacket restoration

Editor's Note: This article is a condensed version of an article first published in the *March/April 2011* issue of *UnderWater Magazine*, the official magazine of the Association of Diving Contractors International (adc-int.org) and appears here with permission.

Fig. 1: H-pile repair underway

constant maintenance cycle for the life of the structure. The cost of materials and labor continues to rise, and these types of repair methods may actually cost more than the original cost of the structure. It was therefore necessary to create a repair system that would be effective on concrete, wood, or steel pilings to prevent future deterioration; not require maintenance; and thus provide an economical, long-term solution to this age-old problem for all substrates.

This article describes the requirements for such a system and the development of a system based on a fiberglass jacket system with epoxy- and cement-based grouts specifically designed for bridge pile restoration. Some examples from the field are also given.

Fiberglass Jacket Systems for Pile Restoration

The basic concept of this system incorporates a pre-molded fiberglass jacket specifically designed for the pile to be repaired. This jacket may be round; square; rectangular; H -shaped; or customized from a series of flat or curved pieces to be connected to cover a large structure (Figs. 1 and 2).

The jacket should be sized to create an annular void of ½" or larger, to be filled with epoxy grout or a combination of epoxy grout and a special underwater cement-based grout, depending on the type of pile and the extent of the section loss.

During the initial development of this type of system many elements had to be addressed, such as the following.

- The system would have to be user friendly. No matter how effective the system was, if contractors and divers could not easily install the system, there would be great reluctance to use it.
- The system would have to be equally effective on concrete, steel, and wood piles.
- The system would have to be effective

Fig. 2: Fiberglass jackets are available in a variety of shapes (clockwise from left): square, round, octagonal, translucent and custom size.

above and below the waterline. The jacket and filler materials must be able to be placed underwater if necessary.

- The system must employ sections that can be easily connected for long pile length repairs where necessary
- The system would have to be placed without dewatering of the annular void between the existing pile and the fiberglass jacket. The filler materials must displace the water out of the void.
- Placement of the system should not interfere with the activity of the structure. The bridge should not have to be shut down to install the system.
- The system must be effective in salt water, fresh water, and brackish water.
- The system must be able to be modified in the field to fit around bracing, piping, hangers, etc.
- The grout must bond tenaciously to the wood, concrete, or steel piles as well as the fiberglass jacket. It must be pourable or pumpable and must fill all voids without the use of external or internal vibration.
- The components of the system must be environmentally safe to marine life.
- The system must stop all corrosion and deterioration in the area it is applied to.
- The system must be maintenance free.

Early Testing by State Roads Commission

To meet all of the above requirements, testing began in 1969 and continued through the 70's and 80's to evaluate the merits of a fiberglass jacket pile repair system. Extensive testing was performed on the fiberglass jackets, as well as on epoxy- and

cement-based grouts. In 1969, the Maryland State Roads Commission laboratory performed tests on an early fiberglass jacket system to determine the effective bond between the fiberglass jacket and the epoxy grout. After placement, the epoxy grout was allowed to cure for 7 days. To remove the fiberglass jacket from the test pile section, the technicians had to destroy the jacket because the epoxy grout had bonded so tenaciously to the jacket and the pile. A three-inch core sample was taken through the epoxy and the concrete pile section using a diamond core drill. The epoxy grout exhibited full bond to the pile, with bond strengths 15-20% higher than the minimum required by MD, thus producing a monolithic structural system.

It was concluded that the epoxy grout bonded tenaciously to the fiberglass jacket even when poured into a void containing salt water.

More recent tensile bond strength results (ASTM D2936) of 2.25-inch diameter, 1-inch long samples from the Choptank River project, were 265–460 (to the nearest 5 psi), with an average value of 345 psi [summary of data attributed to Law Engineering in 1985].

Fiber-Reinforced Polymer System

After the extensive testing, the minimum requirements arrived at for the remedial system, were a fiber-reinforced polymer jackets fabricated from a UV stabilized polyester-reinforced with glass fiber and a 100% solids, moisture insensitive epoxy resin or cement-based grout with an anti-segnot admix (or both).

In addition, the minimum required physical properties of the polymer were determined to be the following.

- Water Absorption (ASTM D-570): 1% max.
- Ultimate Tensile Strength (ASTM D638) Longitudinal, Transverse and Diagonal: 15,000 psi min.
- Flexural Strength (ASTM D796): 25,000 psi min.
- Flexural Modulus of Elasticity (ASTM D790): 700,000 psi min.
- Barcol Hardness (ASTM D-2583): 45 minimum
- Color: Federal Color Standard No. 595A-Table VIII- 26622- Gray or Translucent

Early Projects Using the Fiberglass Jacket Concrete Piles

Norfolk, VA

One of the first projects to utilize the fiberglass jacket and epoxy system was the 26th

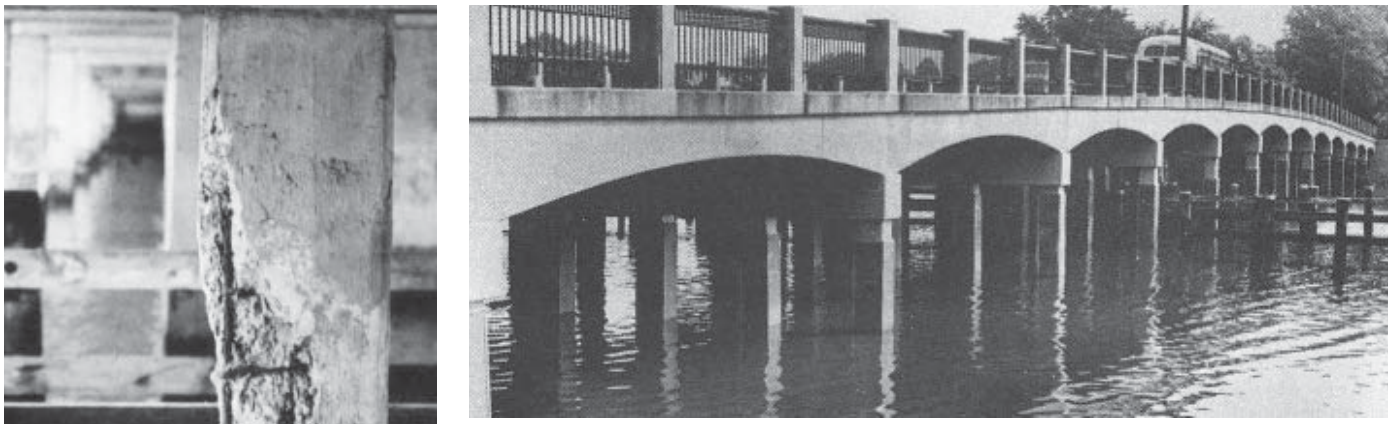

Fig 3.: The first image shows a severely deteriorated pile at the 26th Street Bridge in Norfolk, VA; the second shows the completed restoration, 106 piles in total.

Street Bridge in Norfolk, VA (Fig. 3). The original plans called for placing a square shaped jacket around the deteriorated square piles and filling the void with the moisture insensitive epoxy grout. However soon after the job began it was discovered that the section loss of the concrete piles was much greater than anticipated. This would greatly increase the amount of epoxy grout that would be required to fill these larger voids. The more epoxy, the more expensive the job would be. The city of Norfolk, VA worked with the company that developed the fiberglass jacket system to

find an economical solution to this problem. As the area had an abundance of river gravel, testing was carried out to see how the epoxy grout would react when mixed with the river gravel. Test cubes were made and it was determined that the epoxy mixed with the river gravel would far exceed the minimum requirements of the design strength for the epoxy grout. The river gravel increased the yield of the epoxy to the extent that the project was able to come in on time and on budget.

Annapolis, MD

In the early 1980's the fiberglass jacket system was utilized to repair and protect over 300 Raymond Hollow Piles on the Chesapeake Bay Bridge in Maryland (Fig. 4, p. 58). The piles measured 54 inches in diameter. The piles were exhibiting deterioration in the form of cracks that would allow moisture and salt to penetrate the piles. The structure was located in a region where the temperature ranges from 0 F to 100 F. If left untreated, the deterioration could cause structural damage to the piles that would eventually endanger the bridge. Based on testing conducted by the Maryland State Roads Commission in the 1970's, and successful use of the fiberglass system on other structures, a contract was let to place the system on more than 300 piles. The jackets (55" in diameter x 1/8" thick x 8' long) were placed in the splash zone where the wetting and drying cycles and freeze thaw cycles were concentrated. The ½" annular void was filled with the moisture-insensitive epoxy grout without dewatering. The jackets were inspected 20 years later and were still performing like the day they were placed (Fig. 5, p. 58).

Wood Piles

In the late 1970's, following the implementation of the Clean Water Act of 1972, it was noted that as the harbor waters were cleaned up, they became a breeding ground for marine animals, including borers, which are a great threat to timber piles supporting bridges and piers.

The marine boring animals would burrow their way deep into the wood piles to the point at which the piles would become structurally unsound. Again, testing was performed on timber pile sections to determine the effectiveness of the jacket system. The epoxy grout easily penetrated the bore holes and tunnels and filled them while filling the annular void between the jackets and the piles. Over the past 30 years, thousands of wood piles have been repaired with the fiberglass jacket system. Figure 6


Fig. 4: (left) Piles under the Chesapeake Bay Bridge showed extensive scouring due to conditions; (right): the bridge after the restoration has been completed.


Fig. 5: The Chesapeake Bay Bridge, pictured 20 years later. The piles restoration still looks as good as if it was just completed.

(p. 59) shows an early timber pile repair project.

Steel Piles

Many bridges are constructed with steel pipe and steel H-section piles. Steel will deteriorate differently from concrete or wood. Corrosion of the steel, the most common type of deterioration, may be caused by wetting and drying cycles, chemical attack, and exposure to the atmosphere.

Steel H-piles can be repaired in several ways (Fig. 7, p. 60). Fiberglass jackets can be fabricated in the shape of the H-pile, formed from two pieces to ease installation around the H-pile (Fig. 8, p. 61). The void between the pile and the jacket needs to be a minimum of ¾ in. to account for variances during the fabrication process, which is filled with the moisture-insensitive epoxy grout.

Another method of repairing steel H-piles with fiberglass jackets is to place a circular jacket (Fig. 9, p. 61) around the steel pile and fill the bottom 6 in. of the void with the epoxy, then fill with a more economical, specially formulated cement- based grout that can be poured or pumped into the void without dewatering and finishing with the epoxy for the top 4 inches. By thus encapsulating the cement grout with epoxy, the pile is protected from moisture and air.

Specifying the Correct System

Since there are many different repair scenarios, it is important to choose the right repair system for each project. The following are the important factors to consider when choosing the type of fiberglass jacket and repair grout.

- Type, shape, and length of pile repair
- Number of piles to be treated
- Location of the piles. Are they easily accessible? Are they close to each other? How much head and working room is there? Are the piles completely underwater, or partly underwater? Are there any obstructions like cross-bracings, piping, or hang-

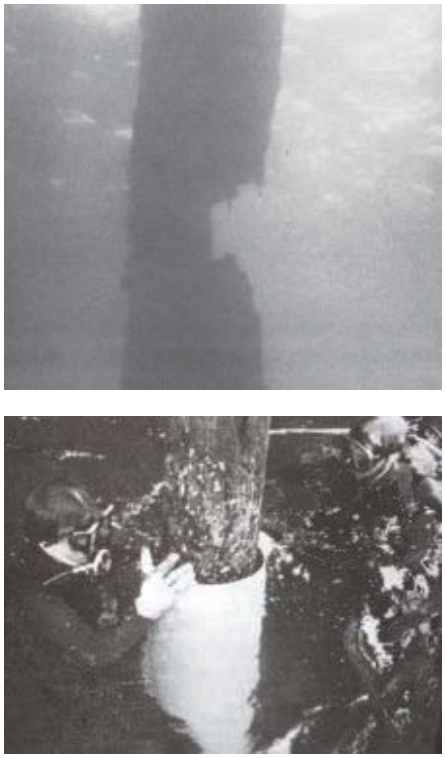

Fig. 6: An early timber pile repair project.

ers? Can the piles be accessed from the pier, work barge, or platforms?

- Cause of deterioration
- Amount of section loss
- Weather conditions
- Amount of work to be performed by divers and by workers above water.

The consideration of these factors will help the engineer, owner and contractor make an informed decision on the best system combination for a specific project.

The two most common types of pile repairs using this system are based on section loss.

- Section loss of 25% or less. This type of repair comprises a ½-inch annular void between the jacket and the pole, which is filled with the moisture insensitive epoxy grout.
- Section loss of greater than 25%. This type of repair comprises a 2-inch or greater annular void between the jacket and the pile. The bottom 6 in. are filled with the moisture-insensitive epoxy grout and the majority with a special non-segregating cement grout up to 4 in. from the top, which is filled with the moisture-insensitive epoxy grout.

Conclusions

Since the 1970's, thousands of concrete, wood, and steel piles have been successfully repaired and restored to their original structural integrity (or even beyond this). The fiberglass jacket system of pile repair has proven to be an effective, economical, and long-term repair system all over the world. The system is being constantly improved to enhance the durability, ease of installation, and cost.

Fig. 7: Inland Steel Water Intake System before and after restoration with fiberglass jackets.

With the many successful projects that have been completed around the world, the fiberglass jacket pile repair system has proven that it is a viable and economical solution to the problem of bridge pile deterioration.

About the Authors

Carl Scheffel Sr. P.E. is president and chief engineer at Fox Industries. Since starting at Fox in 1970, Carl has provided material recommendations regarding the selection and application of engineered

materials specified for concrete on both new construction and rehabilitation projects.

Before joining Fox, Carl spent 15 years

Fig. 8: Steel H piles repaired with an H-shaped fiberglass jacket.

Fig. 9: Steel H pile repaired using a round fiberglass jacket.

as a consulting engineer, he working as a construction project engineer and as a bridge design engineer.
Carl has extensive knowledge of underwater construction methods relating to piers, piles, bulkheads, and other submerged structures.

H. Michael (Mike) Simpson is Fox's technology & application specialist. He graduated from the University of Baltimore in 1972 and began his career with Fox in the Technical Services division. He then moved to a technical sales and service position where he worked

closely with contractors, engineers, and owners to solve concrete restoration problems. He is actively involved in developing product specifications and technical data for Fox products.

He is a long-term member of the International Concrete Repair Institute (ICRI), has authored articles in the JPCL, and has led a JPCL/SSPC Webinar on Concrete Repair Methods. JPCL

Editor's Note: Fox Industries was recently acquired by Simpson Strong-Tie.

SSPC Gives Guidance on Protective Coating Specifications

For many decades, some owners and engineers have considered protective coatings as "incidental" work not requiring any specialized expertise. With the changes that have occurred in protective coatings in the past 60+ years, treating coatings as incidental work can produce costly errors.

Up until the designation of hazardous materials in paint, it was common for owners to allow contractors to scrape these materials and paint with primers. The replacement coatings are much more complicated, and there is less room for error in using high-performance industrial coatings today.

The purpose of the report is to describe some best practices for preparing and administering a quality specification for application of high-performance protective coatings and linings to industrial structures. The report focuses on developing an appropriate set of requirements for applying coatings and linings.

All parties involved in coating contracts can benefit from the information presented in the report, but the primary audience includes public and private facility owners, coating program managers and engineers, and architecture-engineering firms responsible for preparing coatings specifications for clients.

The report does not cover the formatting of the specification document or contract language intended to manage risk. Also, the document does not provide legal advice.

Part 1: The Contracting Environment

Part I describes the contract environment and outlines tools that the specification developer (designer) can use to develop specifications.

Types of Coating and Lining Contracts

A coating specification is the part of a coating contract that details the qualitative and quantitative requirements of the process and finished product. There are many types and variations of contracts used in the construction industry. The report focuses on the specifications for competitively bid contracts, or "low bid" contracts. The report is also applicable to other contracts, but some tailoring of the requirements discussed may be necessary.

Creating a Level Playing Field

The competitive bidding process is generally thought by public agencies to be the most equitable way to distribute public contracting funds. Competitive bidding is only competitive, however, when the entire process is fair to all potential bidders. Designing a good specification can help work toward achieving a more equitable contracting environ-

Editor's Note: The following is a summary of an SSPC report on Preparing and Using Protective Coating Specifications. The article attempts to highlight the main points of the report but does not represent all information that SSPC has provided to write a coating specification. The total report consists of two parts, which are summarized here, and four appendices, which are not summarized. The subject of this article, "Preparing and Using Protective Coating Specifications," is available at no charge to SSPC members and facility owners. SSPC members can go to www.sspc.org/market-place/technical-insight-reports to download the report. Non-member facility owners can request a copy from Michael Damiano, damiano@sspc.org.

SSPC holds classes around the world on good practice in all aspects of coatings projects. Photos on pp. 63 and 64 are from recently held courses. Photos courtesy of SSPC.

ment. A level playing field encourages contractors to be more efficient in all aspects of planning and executing work.

Identifying and addressing the root causes of competitive bidding problems and writing a specification to close gaps and potential loopholes will most likely enhance project success as well as restore confidence in the competitive bidding process.

Roles of the Contracting Parties

The agreement between the facility owner and the contractor is typically one in which the contractor will perform the specified requirements, and the owner will pay the contract price.

The Owner: The owner should develop a complete and unambiguous description of the work, enforce and manage the project requirements, and coordinate actions. The design must be accurate and complete so that contractors can properly estimate the cost of full contract conformance. Developing a good specification reduces the chance of getting wildly low bids.

The designer's chief responsibility is to establish and convey project requirements in the specification. With a well-written and executed specification, the owner is much more likely to receive the desired product. However, if the specification is weak, vague, ambiguous or incomplete, the owner may encounter problems such as unrealistically high or low bids, bids from unqualified contractors, costly change orders for additional work, costly delays resulting from disputes, costly litigation, and defaulted contracts.

SSPC supports owners hiring qualified coating specialists or having persons become qualified through SSPC, NACE, and other industry programs. More information about the SSPC Protective Coatings Specialist (PCS) Program can be found here: www.sspc.org/Protective-Coatings-Specialist-PCSProgram/. In addition, *JPCL*/PaintSquare maintains a list of coating industry consultants.

The Contractor and Subcontractors: The contractor is responsible for planning, scheduling, and producing work that conforms to all contract requirements. The contractor is also required to provide objective evidence of conformity (documentation) of completed work to project requirements.

When a subcontractor is used for specialized work such as coating, the prime contractor must provide documentation that the qualifications of the coating subcontractor are equal to those of the prime contractor, or as specified.

The full report discusses steps that the contractor can take to clarify any vagueness in requirements.

The Inspector: The owner may or may not specify qualifications for the contractor's inspectors and may or may not hire Quality Assurance (QA) inspectors to monitor the contractor's Quality Control (QC)/QA inspection and documentation.

Inspectors must verify that the work meets all specification requirements. Inspectors are expected to provide honest, unbiased data in

reporting of tests and observations that are specified for determining conformance of the work.

Legal Concerns in Coating Contracts

Because coating contracts are legal documents, it is important to consider various legal concerns when writing the specification and drawing up the contract. The full report provides a suggested list of items that a contracts attorney should pay special attention to when reviewing the final contract.

A well-written specification should eliminate or minimize issues such as contract deviations (often called variances), differing site conditions (site variations), and nonconformities.

Corrective and Preventive Action

A set of tools to be used during contract performance has proven to be particularly effective in minimizing the occurrence and recurrence of nonconformities with the specification. Corrective Action (CA) and Preventive Action (PA) can keep the contractor focused on producing conforming work.

CA identifies the root cause of a nonconformity, takes steps to eliminate it, and then follows up to ensure that the nonconformity does not recur. While CA is reactive in nature (responding to identified nonconforming work), PA is proactive in nature. It makes use of knowledge and past experience to prevent nonconformities from occurring in the first place.

Basic Expectations from a Contractor's QMS

A quality management system (QMS) addresses the principles and processes surrounding the design, development, and delivery of a general product or service. Specifying a QMS standard as a preliminary requirement of the contractor sets up a process of organized activities to meet established goals.

The owner should have expectations from the contractor concerning the work to be accomplished. The most important expectation is that only work conforming to the specification will be tendered. The report provides more specific expectations of contractors obligated to a QMS.

Part II: Items Commonly Required in Coating Specifications

Part II lists key elements of the specification and describes their functions.

Coordination Requirements

To be fully effective, the technical specifications must be coordinated with the owner's "front-end" documents, as well as the general requirements for each project. The front-end documents (e.g., General Conditions, Additional General Conditions, Special Conditions, etc.) establish the legal contracting environment.

Foundation of the Specification

Coating specifications can be very complex documents, even without considering the thousands of seemingly mundane issues that are encountered on every project. The coating industry has covered many of these issues for coating of industrial steel structures in SSPC-PA 1, "Shop, Field, and Maintenance Printing of Steel." Each coating specification for steel structures should start with SSPC PA 1 as the foundation and be modified as needed to create a complete specification that gives both the contract administrator and the contractor a complete description of requirements. SSPC-PA 7 should be used for concrete structures.

Key Elements

Scope of Project: Specifications should have introductions that describe the general scope of the project to prospective bidders. Enough information should be presented in the scope section to permit potential bidders to determine whether they are interested in investigating the proposed project further.

The specification must define all of the areas that are to be coated and all of the areas that are not to be coated.

The Site: The owner must provide contractor personnel with access to the work site. Sufficient area should be provided for the contractor to store required equipment and materials.

Bidders should identify discrepancies they find prior to submitting bids, but a reasonable alternative is to require the contractor to advise

the contract administrator of any discrepancies within a reasonable time after contract award. The project site condition should be fully described including any environmental limitations or other conditions that might affect project work.

References/Applicable Documents: A reference section of the specification should provide a listing of all documents cited in the specification and no others. There should be a section detailing the precedence of documents in the event of a conflict. In addition to SSPC, technical organizations that provide standards and other guidance relevant to coating projects include ASTM, API, AWWA, FHWA, NACE, and NSF.

A section should include definitions of all words and terms used in the specification that are not universally understood. Because they are more widely used in the coatings industry, industry standard definitions such as those in SSPC's *Protective Coatings Glossary* are normally preferred to those of governmental organizations.

Submittals: Submittals are the required documents, information, or products (samples) for owner or designer review to assure conformity with the specification. Paint submittals are typically required to ensure the contractor is intending to use the specified products in accord with the manufacturer's recommendations and the specifications.

A submittal section requires the contractor to regulate the timely flow of materials and documents used on the project and ensure their compliance with specification requirements.

Safety and Health Plans: SSPC-PA Guide 10, "Guide to Safety and Health Requirements for Industrial Painting Projects," provides guidance for specifying safety and health requirements for contractors. SSPC-Guide 17, "Guide to Developing a Corporate Safety Program for Industrial Painting and Coating Contractors," is also usable by owners to evaluate contractors' safety programs.

Work Plan, Process Control Procedures (PCPs), etc.: A Work Plan is a written document containing a list of all actions and procedures, assembled to describe all steps necessary for the contractor to produce a finished product conforming to all specification requirements. The Work Plan requirements of the specification into a series of steps for field implementation.

Quality Assurance: A quality assurance section of the specification includes prerequisites, standards, limitations, and criteria that define the quality for products and work.

Qualifications and certification statements may be requested to establish the capabilities of the contractor and those employed or utilized by the contractor. SSPC-QP 1 can help assess a contractor's ability to complete the project work in a satisfactory and timely manner. Additional certifications (e.g., SSPC-QP 2) may be required for special projects, and SSPC offers additional industry-specific contractor Quality Management Certifications for specialty applications such as Shop Coating (QP 3), Metallizing (QP 6), and Coating of Concrete (QP 8).

The coatings industry has multiple certification programs for coating inspection personnel and coating inspection companies. It is recommended that these certifications be used on coating projects (e.g., NACE CIP or SSPC equivalent for inspectors or SSPC-QP 5 for coating inspection companies).

Delivery and Storage of Materials and Equipment: The specification should contain a section with special requirements for packing and shipping products, equipment, and their components, along with special storage, handling, and disposal requirements. An emergency action plan should be in place to respond to accidents involving hazardous materials as well as an OSHA-approved plan for collecting, storing, and disposing of hazardous waste.

Specified Type and Size Range of Abrasives: The specified abrasives should be tested by the referenced test methods, e.g., SSPC-AB 1, for conformance to specification before use.

Kits and Equipment for Testing: Equipment necessary for testing for surface cleanliness, profile, and coating thickness must be available at the work site. The specific parameters and test requirements must be included in the specification if the owner/designer expects those tests to be performed.

Specified Types of Coating Materials: A materials section of the specification lists the coating materials to be used on the project. Occasionally, public works projects require the allowance of an "or equal" clause if a particular product or manufacturer is referenced. Criteria should be specified for determining acceptability of "or equal" submissions. There are specific legal requirements to be met if public owners want to try to "sole source" or limit the paint products.

The VOC content of coating materials is controlled in most U.S. locations. If commercial products are specified, their colors should be selected from the manufacturer's list of available colors. Upon delivery, the coating materials must be identified as those specified and as having sufficient shelf life to complete the project.

Acceptable Ambient Conditions: A section of the specification should list acceptable ambient conditions for surface preparation and coating application and curing or at least require the products to be applied in accordance with the manufacturer's recommendations (as prescribed in SSPC Technical Insight Report on "Monitoring and Controlling Ambient Conditions During Coating Operations").

Cleaning Surfaces: The report describes the required pre-cleaning actions (e.g., grinding of welds and sharp edges) before the actual surface preparation for coating. It also describes the required levels of pre-cleaning.

Abrasive blast cleaning is the most commonly specified surface preparation method for cleaning industrial steel surfaces for coating. Any required special equipment or procedures should be specified along with the required level of cleaning and profiling.

Coating Application: An application section of the specification specifies acceptable methods that may be used to apply the specified materials. Manufacturers' product or technical data sheets are commonly required to provide recommended procedures for application for specific coatings. Application concerns are listed in the document.

Inspection and Documentation Requirements: Project documentation, including inspection and testing records, should be used to determine the contractor's compliance with specification requirements and approved procedures.

A list of action items needing completion is prepared before a final inspection to ensure that all work is complete and ready for the final acceptance by the owner.

Warranty: The warranty section of the specification requires that the materials and equipment be new and of good quality, the work be free from defects, and the work conforms to all contract documents. Warranties for coating work are typically for one year after acceptance of the work. JPCL

Updates Issued for SSPC 2012

The following pages include the known updates for SSPC 2012 featuring GreenCOAT, to take place in Tampa, FL, on Jan. 30 to Feb. 2. All information is current as of press time. For additional updates and a complete schedule, visit www.sspc2012.com.

Exhibitor Updates

- ***Advanced Recycling Systems, Inc.*** phone number should be 330-536-8210.
- ***Diversified Container Services, a Division of ConGlobal Industries*** Jacksonville, FL; phone: 904-765-8110; divconjax.com. Booth 1030.
- ***DoD Office of Corrosion Policy and Oversight*** endeavors to minimize the impact of corrosion to military assets. Arlington, VA; phone: 703-695-2300; corrdefense.org. Booth 1008.
- ***IBIX Surface Technologies LLC*** is the exclusive North American manufacturer representative for low-pressure, eco-friendly, IBIX portable blasting systems. Available with multiple media flow and pressure adjustments. Seminole, FL; phone: 727-776-2992; ibixusa.com. Booth 926.
- ***Kobrin Builders Supply/Sto Corp*** produces a range of versatile cladding and coating systems for building construction, maintenance, and restoration. Orlando, FL; phone: 407-843-1000; kobrinbuilderssupply.com. Booth 307.
- ***Longhai Duoling Saw Blade Co. Ltd.*** has changed its name to **Fujian Duoling Steel Group**. All contact information remains the same, and it will still exhibit in Booth 935.
- ***Luoyang Hong Feng Refractories and Abrasives Co., Ltd.*** is a leading abrasive materials manufacturer in China. Luoyang, Henan; phone: 86 379 63329198; hongfeng-abrasives.com. Booth 1009.
- ***Moisture Control Company*** Baton Rouge, LA; phone: 225-293-6226. Booth 536.
- ***Pinnacle Central Co., Inc.*** has moved to Booth 442.
- ***Shanghai ShengChang Industry Equipment*** manufactures surface treatment technology, pneumatic vacuum and air handling systems, safety equipment, paint test equipment, and non-standard-design blast rooms. Pudong District, Shanghai. Booth 1110.
- ***Thermoset Resin Formulators Association (TRFA)*** is an international trade association comprised of thermoset formulators, raw material suppliers, distribu-

tors, consulting firms, and academic institutions serving several industries including coatings. Glen Wilyn, IL; phone: 630-942-6596; trfa.org. Booth 1014.

SSPC, *JPCL* Awards

SSPC and *JPCL* will present this year's awards at the Annual Business Meeting & Luncheon on Monday, Jan. 30 at 11:00 a.m.

The Honorary Life Member Award will be presented to Joseph Brandon, QualityFirst Consultants LLC. Allan DeLange, North American Coatings, CL Division, will be awarded the John D. Keane Award of Merit. The Technical Achievement Award recipient is Alfred Beitelman, U.S. Army Construction Engineering Research Lab. The Coatings Education Award will go to Ernst Toussaint, The Sherwin-Williams Company. The winners of the President's Lecture Award are Bobby W. Meade, Greenman Pedersen Inc.; Sudhir Palle, University of Kentucky; and Theodore Hopwood II, University of Kentucky.


Allan DeLange


Alfred Beitelman


Ernst Toussaint

The *JPCL* Editors' Awards and the Outstanding Publication Award (to be determined) contenders include:

- "An Inspector's Views from the Field: Should the World Start to Specify the Joint SSPC/NACE Standards?" by Lee Wilson, Consultant; *JPCL*, March 2011, pgs. 20-24
- "Angels and Demons in the Realm of


Mike O'Donoghue


Vijay Datta

Free Webinar Describes QC of Painting Operations

If your name is attached to the quality of an industrial painting operation, you won't want to miss this February's ***free*** SSPC/*JPCL* Webinar, **"Quality Control of Industrial Painting Operations."**

Presented by KTA-Tator's Bill Corbett, this free webinar will cover the industry standards, processes, and equipment employed to verfiy conformance with a project specification.

Free registration for the webinar is currently available online at www.paintsquare.com/education.

Sponsored by:

DeFelsko®
The Measure of Quality

Date:
February 15, 2012
11:00 a.m.-Noon, EST

Register at
paintsquare.com/education

JPCL SSPC The Society For Protective Coatings
Webinar Education Series

Protective Coatings: The Underworld of VOCs," by Mike O'Donoghue, Ph.D.; Vijay Datta, MS; and Russell Spotten, International Paint, LLC; *JPCL*, April 2011, pgs. 14-29

• "Painting Practices for Floating Production, Storage, and Offloading Systems," by Michael B. Surkein, Robert H. Rogers, and Sophia Woodley, ExxonMobil Development Corporation; *JPCL*, Feb. 2011, pgs. 26-41

Michael B. Surkein

• "Sizing DH for Water Tank Lining Jobs," by Don Schnell, formerly with Dehumidification Technologies, LP; *JPCL*, May 2011, pgs. 20-26

Don Schnell

• "Strategic Corrosion Protection of New Sewerage Overflow Tunnels," by Bob Maley, Corrosion Probe, Inc., and Steve Kelso, Sauereisen, Inc.; *JPCL*, Feb. 2011, pgs. 42-53

Bob Maley

Steve Kelso

• "Testing Permeation Resistance in Coatings for Wastewater Structures," by Vaughn O'Dea, Caleb Parker, and Rémi Briand, Tnemec Company; *JPCL*, Sept. 2010, pgs. 16-28

Caleb Parker

Vaughn O'Dea

Rémi Briand

• "Understanding Inorganic Zinc-Rich Primers and Specifications," by Dr. Ilhan Ulkem and Mike Winter, Worldwide Protective Coatings, International Paint, LLC/AkzoNobel, Inc.; *JPCL*, Dec. 2010, pgs. 40-48

Changes to Committee Meetings

On Wednesday, Feb. 1, the TG 323, Wet Abrasive Blast Cleaning Report, has been cancelled. C.2.12, Location of Salt Measurements Committee, and C.1.1, Paint 29 Revision Committee, will both take place from 3:30–5:00 p.m. on Wednesday. Both were originally scheduled for 3:00–4:30 p.m.

On Thursday, Feb. 2, C.1.13, Wastewater, and C.5.3.A, Containment (Guide 6 Revision), will both take place from 10:30 a.m. to noon. Both were originally scheduled from 10:00 a.m. to noon. Also on Thursday, C.1.4.C, Waterborne Acrylic (Paint 23 Revision), and the Education Committee Meeting have been cancelled.

Updates to the Technical Program

• "Writing a Good Process Control Procedure," by Rick Smith, PCS, Wheelblast, Inc., will take place from 3:30–4:30 p.m., on Monday, Jan. 30, during the "Improving Your Business Through Strategic Planning" track. It was previously scheduled for 3:30–4:00 p.m.

• On Monday, Jan. 30, there are two changes to the track, "Nanotechnology: Enhancing the Performance of Coatings." From 2:30–3:00 p.m., Todd Hawkins, Tesla Nanocoatings Limited, will present, "Nanocoatings for Harsh Environments." The 3:30–4:00 p.m. slot is TBD.

• "New Solvent-Free Waterborne Epoxy

Resin Dispersion for Low VOC 2-Pack Protective Coatings," will be presented on Tuesday, Jan. 31, from 10:00–10:30 a.m. by Dr. Matthias Zeynerts, Cytec. Ming Tsang was originally scheduled to present this paper, which is part of the "Advancing Green Technology" track.

- From 11:30 a.m. to noon on Tuesday, "Ship Hull Performance in the Past TBT Era," will now be presented by George Aristizabal, The Hydrex Group.
- Two papers have been added to the Tuesday afternoon section of the track, "*Durability + Design* Commercial Coating and Flooring Symposium." Joe Reardon, PROSOCO Concrete Products Group, will present, "Hard Truths About Concrete Polishing," from 2:00–2:30 p.m., and Ken Trimber, KTA-Tator, will present, "The New SSPC Commercial/Light Industrial Committee," from 4:00–4:30 p.m.
- From 3:00–3:30 p.m. on Tuesday afternoon, Michael Stelmach, Mascoat, will present "Thermal Insulating Coatings—The Future of Insulation," as part of the "Real World Coatings in Action" track. The paper, "Colored Pigments for Coatings—Chemistry & Performance," was previously scheduled for this time slot.
- On Wednesday, Feb. 1, one presentation has been added to the track, "Keeping it Clean—Coatings for Wastewater." Bob Murphy, The Sherwin-Williams Company, will present, "Wastewater Treatment Plants—Doing it Right Makes Sense," from 3:00–3:30 p.m.
- On Thursday, Feb. 2, one presentation has been added to the track, "Field & Laboratory Testing." John F. Fletcher, Elcometer Limited, will present, "High Voltage Porosity Testing Continuous DC vs. Pulsed DC," from Noon–12:30 p.m.
- In the Thursday track, "Maintenance Painting—Fountain of Youth," Michael Doolittle, Tank Industry Consultants, will be presenting, "Rehabilitation of National Water Storage Landmark," from 3:00–3:30 p.m. Gregory Stein was previously the scheduled presenter.

SSPC and Australasian Corrosion Association Sign Training Agreement

In November, SSPC Executive Director Bill Shoup met with the officers of the Australasian Corrosion Association (ACA) in Australia to sign a license for the ACA to deliver SSPC's Abrasive Blasting (C7) and Airless Spray Basics (C12) Programs.

SSPC's Immediate Past President, Russ Brown, started preliminary discussions with the ACA officers, and the associations came to an agreement in October. The official signing took place at the 18th International Corrosion Congress (ICC) in Perth, Australia, in November.

The ACA will follow all of SSPC's procedures for delivering the training, but will make adjustments to the course material to ensure that the content is compatible with Australian regulations.

SSPC Director of Member Services Terry Sowers said, "We feel that this is a very beneficial partnership for SSPC and ACA. Part of SSPC's mission is to make world-class traning programs available to our members at a reasonable cost. We think ACA shares this philosophy. Together, we can raise the level of knowledge of our members and improve the level of work done in the industry."

SSPC and ACA hope to begin offering the first courses in mid- to late-2012.

SSPC Executive Director Bill Shoup (right) exchanges the signed MOU with the President of IMM, Dato Dr. Ong Eng Long (left). Second Row (l-r): Max Ong (Honorary Secretary—IMM); Prof. Dr. Kamal Harun (Dep. Pres.—IMM); Prof. Dato Dr. Mansor Salleh (Immediate Past Pres.—IMM); and Thomas Jones (SSPC Senior Auditor for QP Programs)

SSPC and Institute of Materials Malaysia Sign MOU

In March 2011, SSPC participated in a small but successful coatings seminar in Kuala Lumpur. After the seminar, a meeting took place between SSPC's Senior Auditor for QP Programs, Tom Jones, and the officers of the Institute of Materials Malaysia (IMM) to discuss further cooperation between the organizations.

The IMM is a non-profit society of professionals who aim to promote honorable practice and professional ethics and encourage education in materials science, engineering, and technology.

In May 2011, SSPC Executive Director Bill Shoup traveled to Kuala Lumpur to meet with the IMM officers. The organizations agreed to develop a Memo of Understanding (MOU) to commit time and resources to work together on joint training programs for industrial coatings. The group hopes that future collaborations will include the development of joint publications and standards.

The MOU was signed on Nov. 15, 2011, at the Advanced Coatings and Standards Technology Seminar in Kuala Lumpur.

Shoup said of the agreement, "SSPC believes that we must create international partnerships and collaborations for the good of the industry and the association. The world is getting smaller, and we need to reach out to other groups who share similar goals. We feel fortunate to be working with the IMM and look forward to a long and successful relationship."

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SSPC's C3 Course in Lewiston, NY

SSPC's C12 Course in Philadelphia

Training Updates

SSPC held its Airless Spray Basics (C12) course on Nov. 28–30, 2011, hosted by the Aker Philadelphia Shipyard in Philadelphia, PA. The instructor was Gordon Kuljian, and 21 students participated.

The Aker Philadelphia Shipyard (APSI) is a leading U.S. commercial shipyard, constructing vessels for operation in the U.S. Jones Act market. It possesses a state-of-the-art shipbuilding facility and has earned a reputation as the preferred provider of oceangoing merchant vessels.

SSPC held its Lead Removal (C3) course on Oct. 31–Nov. 3, 2011, hosted by Greenman Pedersen, Inc., in Lewiston, NY. The instructor was Fred Smith. JPCL

Primeaux to Direct VersaFlex Training

Dudley J. Primeaux II

Dudley J. Primeaux II has joined polyurea supplier VersaFlex Inc. (Kansas City, KS) in the new position of director of education and development.

Recently named a *JPCL* Top Thinker in the coatings industry, Primeaux will lead VersaFlex's extensive 14-level training program. The company offers training year-round in Houston, TX; Europe; and Asia. According to VersaFlex, Primeaux has been conducting its training classes for a number of years, and he developed the company's training curriculum for levels 1-7.

Primeaux has been involved in polyurea since the field's early development in the 1980s. He has authored more than 40 technical papers relating to the industry and holds more than 30 patents. He has experience in the preparation of new raw materials, formulation development, application equipment usage, field application work, and failure analysis of coating and lining projects.

Primeaux heads his own consultancy, Primeaux Associates LLC, in Elgin, TX. He is also an SSPC-certified Protective Coatings Specialist (PCS) and certified Concrete Coating Inspector (CCI), and an active member of SSPC, NACE, and other industry organizations. He will also continue in his role as consultant to VersaFlex on product development.

Dur-A-Flex Names R&D, Marketing VP

Polymer floor and wall systems supplier Dur-A-Flex has named David Hughes vice president of marketing, research & development. His efforts will focus on new applications and product rollouts. He also will oversee the company's marketing, including the tradeshow channel, lead generation program, and product management.

David Hughes

Hughes was a former business director of BASF Corp. and a former vice president for Ciba Specialty Chemicals.

Hughes has a bachelor of science degree in chemical engineering from England's Bath University and has pursued educational opportunities, including e-business in B2B and financial accounting in the chemicals business.

Based in East Hartford, CT, Dur-A-Flex manufactures epoxy, urethane, methyl methacrylate, and colored aggregates and offers high-performance polymer flooring and wall systems.

KKR Buys Capital Safety for $1.12B

Capital Safety, a global supplier of fall protection, confined space, and rescue equipment, has been sold to investment buyout firm Kohlberg Kravis Roberts & Co. (KKR) for $1.12 billion.

The deal, announced November 28, should be completed in January, said Minnesota-based Capital Safety, which manufactures the DBI-SALA, Uniline, and Protecta brands and has corporate roots dating to 1938.

Capital Safety makes lanyards, harnesses, vertical and horizontal systems, con-

Webinar Explains How to Measure Adhesion to Concrete

The SSPC/JPCL Education Series Webinar, **"Measuring Adhesion to Concrete,"** will be presented on Wednesday, February 29, from 11:00 a.m. to Noon, EDT. Participation is free.

The webinar will explain how to perform an adhesion pull-off test on coatings over concrete according to ASTM D 7234 and will review and discuss the variables that can affect the results.

The presenter will be David Beamish of DeFelsko, which is the sponsor of the educational session.

Free registration for the webinar is currently available online at www.paintsquare.com/education.

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Date:
February 29, 2012
11:00 a.m.-Noon, EST

Register at
paintsquare.com/education

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fined space, descent, rescue, and other safety equipment for the oil and gas, utilities, energy, and other markets.

KKR will continue to invest in the company and expand those products and markets, said Capital Safety CEO Anders Pettersson.

Ergon Buys Henkel's Corrosion Group

Ergon Asphalt & Emulsions Inc. (Jackson, MS) has acquired Henkel Corp.'s Corrosion Engineering Division, which provides corrosion-protection lining systems for a variety of industries.

The division, based in Lester, PA, joined the ErgonArmor technical coatings group under the new name Corrosion Engineering, effective December 2011.

Sika Acquires Duochem

Sika AG has acquired Duochem Inc., a Canadian supplier of waterproofing coatings and membranes used to protect concrete structures.

Switzerland-based Sika made the acquisition, effective November 30, through its subsidiary, Sika Canada.

Sika AG is a specialty chemicals company that supplies sealing, bonding, reinforcing and concrete protection materials to the building, manufacturing, and construction industries.

Fischer Technology Opens CA Office

Fischer Technology Inc., manufacturer of coating test instruments, has announced the opening of a new sales and service office in San Mateo, CA.

The San Francisco-area "Fischer West" office, run by Jim Bogert, supports the company's complete line of coating thickness, material testing, material analysis, and micro-hardness instrumentation. The office's services include onsite re-certification of handheld coating thickness gauges and bench-top X-ray fluorescence instruments, repairs, and preventive maintenance.

Fischer Technology also has sales and service centers in the Chicago area and at the company's headquarters in Windsor, CT.

Products

'Junior' Vac Needs No Compressed Air

Camfil Farr Air Pollution Control has introduced a pulse-cleaned industrial vacuum with dual-stage HEPA filtration that is designed to drastically minimize clogs, preventing loss of suction and related problems during cleaning.

The FarrVac Junior uses a patented pulse-cleaning technology that works without compressed air, the manufacturer reports. Filters are cleaned every 10 seconds, preventing clogging.

The unit may be used for everyday shop cleanup or as an accessory to an installed dust collector when replacing or emptying dust drawers or drums.

The unit comes equipped with spun bond polyester filters that Camfil says last up to 10 times longer than conventional filters. Two primary HEPA filters provide 99.97% efficiency on dust particles to 0.3 micron.

The unit has a 120 cfm motor; operates on 120VAC, 50/60 Hz power; and comes

equipped with an eight-gallon tank, hose, and hard-floor wand kit. An aluminum wand and floor sweep are available as options.

More information: www.farrapc.com/products/farrvac/junior

Explosion-Proof Light for Field Use

Western Technology has introduced a portable, rugged new utility light for blast, paint, and inspection applications in hazardous locations.

The new Striker Model 8100-3 is approved for use in both gas and combustible-dust applications.

The utility light is approved for Class I and II, Division 1 and 2 uses and is designed for safety, durability, application flexibility and bright lighting intensity. There are no hot filaments, broken bulbs, or ballast to replace and no disposal of mercury or gases, the company reports.

Features include an impact-resistant bumper designed to hold both a disposable outer lens and light diffuser; multiple mounting and support choices; single hand-held or drop light, or a multiple drop string light configuration; a low-voltage option; and a full light spectrum designed to allow the operator to see detail.

More information: www.westerntechnologylights.com

Dryer Features Four-Stage Pre-Filtration

Walmec North America has introduced the WNA AMD-035 Membrane dryer, designed for compressed-air applications that require ultra-clean, ultra-dry air.

The dryer has four-stage pre-filtration, a flow rating of 35 SCFM, and a maximum working pressure of 150 psi.

According to the company, the dryer's first- and second-stage filters remove mois-

ture, liquids, dust, rust, scale, and other contaminants to 5 microns.

The third and fourth stages remove remaining particles down to .01 microns and absorb any remaining moisture or oil vapors.

The dryer is designed for use with waterborne paints or other sensitive tasks that "require the highest standard of clean and dry compressed air," says the manufacturer, which calls the unit easy to install, use, and maintain.

More information: www.walmecna.com

Nordson Unveils Quattro Airless Sprayer

Industrial coating equipment maker Nordson Corp. (Westlake, OH) has introduced an automatic spray gun designed to increase productivity and improve finish quality.

The new Quattro automatic spray gun incorporates fast cycling, fine atomization, and easy maintenance for general finishing in either non-circulating or circulating heated airless applications, the manufacturer says.

The stainless-steel unit features a four-in-one valve design to enable automatic color changing without having to reposition the spray gun, according to Nordson.

When used with Nordson nozzles, the Quattro can provide improved atomization with a wide range of coating materials, including high-solids and other difficult-to-spray coatings for minimal paint waste, the company says.

An optional heater is available to reduce and control material viscosity for improved operating performance and efficiency.

More information: www.nordson.com

New Gardner Paint Test Manual Released

ASTM has published the venerable *Paint and Coating Testing Manual: 15th Edition of the Gardner-Sward Handbook.* It contains 79 chapters, written by experts, on new and updated technologies within the paint and coatings industry.

According to ASTM, the manual is a comprehensive guide to the paint and coatings topics, test methods, procedures, and standards of ASTM and other national and international organizations. New and updated topics include powder coatings, osmotic activity in coatings and coalescing aids.

ASTM develops and delivers international voluntary consensus standards.

For more information: www.astm.org

JPCL

Project Preview

Photos courtesy of Seacoast Utility Authority

By Charles Lange, Paint BidTracker

Atlantic Painting Wins WWTP Contract

The Seacoast Utility Authority of Palm Beach Gardens, FL, awarded a $159,700 contract to Atlantic Painting & Sandblasting (Boynton Beach, FL) to clean and coat metal and concrete surfaces at the PGA Wastewater Treatment Plant. Items to be coated include the exterior of the operations building, the interior of the sludge loading area, the polymer room and the second floor of the operations building, the interior and exterior of the north blower building, the exterior of the chlorine contact chambers, the exterior of a digester, multiple pump stations, and miscellaneous piping systems. The metal and concrete will be coated with various cementitious waterproofing, acrylic, epoxy, polyurethane, and fluoropolymer coatings.

West Co. and Dunkin & Bush Team Up on Ione Bridge Rehab

Photo courtesy of Washington State Tourism

West Company (Airway Heights, WA) was awarded a $3,628,347 contract from Pend Oreille County (WA) to rehabilitate the Ione Bridge, a 15-span, 830-foot-long deck truss bridge over the Pend Oreille River. The bridge was built in the 1930s and last received major maintenance in the late 1960s.

West awarded Dunkin & Bush (Kirkland, WA), SSPC-QP 1-, QP 2-, and QP 3-certified, a subcontract worth approximately $1,600,000 to perform Phase II of the project, which involves cleaning and coating a total of approximately 97,770 square feet of structural steel, grid deck, railing, post, pile tie, and expansion joint cover surfaces and 20 bearing assemblies, as well as cleaning, sealing, and caulking 500 linear feet of pack rust. Containment is required to capture the existing lead-bearing coatings. The project also includes shop-priming and field-finishing new steel, as well as installing 450 square feet of carbon fiber pile jacketing.

Harry's Painting Awarded Power Plant Contract

A contract worth $354,050 was awarded by the City of Lakeland (FL) to Harry's Painting & Enterprises, Inc. (New Port Richey, FL) to clean and recoat steel and concrete elements at the Larsen Memorial and C.D. McIntosh Power Plants. Items to be coated include tanks, stacks, buildings, equipment, stairways and hand railings, and miscellaneous metals. The contract calls for pressure washing at a minimum of 3,500 psi; hand-tool and power-tool cleaning (SSPC-SP 2, SP 3, and SP 11); and abrasive blast cleaning to both Commercial and Near-White finishes (SSPC-SP 6 and SP 10); as well as coating the steel and concrete with various systems, including heat-resistant inorganic zinc, zinc-epoxy-urethane, epoxy mastic-polyurethane, amine epoxy, and acrylic. The contractor must furnish a NACE Level II-certified coatings inspector and erect containment structures according to SSPC-Guide 6.

Photos courtesy of the City of Lakeland

Singing Bridge Painting Goes to G Force

G Force Contracting (Campbell, OH) secured a contract from the Kentucky Transportation Cabinet to clean and paint the historic Singing Bridge, a 405.7-foot-long x 23.9-foot-wide Pennsylvania through truss bridge over the Kentucky River. The bridge was built in 1893 and previously rehabilitated in 1956. The $1,269,080.60 contract includes abrasive blast-cleaning structural steel surfaces to a Near-White finish (SSPC-

Era Valdivia Wins Ruby Street Bridge Contract

An agreement has been reached between Era Valdivia Contractors, Inc. (Chicago, IL) and the Illinois Department of Transportation to repair and recoat the Ruby Street bridge over the Des Plaines River in Joliet, IL. This 396-foot-long x 44-foot-wide trunnion bascule truss bridge was built in 1935 and was last rehabilitated in 1972. The $2,117,343 contract requires SSPC-QP 1 and QP 2 certifications and includes abrasive blast cleaning steel surfaces, including handrails, to a Near-White finish (SSPC-SP 10). The steel will then be coated with an organic zinc primer, an epoxy intermediate, and a urethane finish. The existing coatings contain lead and will require the contractor to use containment.

SP 10) and recoating the steel with a three-coat, urethane-based, organic zinc-rich system. Class 2A containment according to SSPC-Guide 6 is required to capture the lead that is present in the existing coatings. A third-party coatings inspector will be used to perform quality assurance inspection services. The contractor is responsible for performing quality control coatings inspection services, including the provision of an SSPC-C3 competent person to oversee waste handling. The project also includes performing steel repairs.

Murphy to Coat Bridge over Santa Ynez River

A contract valued at $365,990 was secured by Murphy Industrial Coatings, Inc. (Signal Hill, CA) from the California Department of Transportation to clean and coat all existing structural steel surfaces on the 120-foot-long main span of a 685-foot-long steel truss bridge over the Santa Ynez River. The contract requires SSPC-QP 2 certification and includes steam cleaning or pressure washing, abrasive blast cleaning, testing for soluble salts with as-needed chloride remediation (SSPC-Guide 15), and coating the steel with a four-coat waterborne system. The existing coatings contain red lead and require Class 1 containment according to SSPC-Guide 6.

Edgewater Awards WTP Contract to Gulf Coast

Gulf Coast Contracting, LLC (Tarpon Springs, FL), SSPC-QP 1- and QP 2-certified, and the City of Edgewater (FL) have agreed on a contract to clean and coat steel surfaces at the Alan R. Thomas Water Treatment Plant. The $46,550 contract includes coating catwalks, the exterior and weirs of two claricones, exposed ductile iron piping, and aerator column surfaces. Exposed steel surfaces will be pressure-washed at a minimum of 3,000 psi; spot-cleaned using hand and power tools, or brush-off abrasive blast cleaning (SSPC-SP 2, SP 3, and SP 7); spot primed with epoxy; and coated with an epoxy primer and an aliphatic polyurethane finish. Submerged surfaces will be pressure washed at a minimum of 3,000 psi, spot abrasive blast cleaned to a Near-White finish (SSPC-SP 10), and coated with a three-coat epoxy system.

Bridge Painting Contracted to Cosmos

The Ohio Department of Transportation has selected Cosmos Comprehensive Construction, Inc. (Canal Fulton, OH) to clean and coat approximately 133,451 square feet of structural steel surfaces on seven bridges in Hancock and Allen Counties. The $1,416,455 contract includes coating the steel with an organic zinc-rich primer, an epoxy intermediate, and a urethane finish.

CORRECTION: In the November Project Preview, Tom Kousisis of Alpha Painting and Construction Co., Inc. was listed as the president; Kousisis is the project manager for the Tobin Bridge project. Betsy Aikaterinidis is the president of Alpha.

Crossword

by Andy Folmer, PaintSquare

Name That Painter

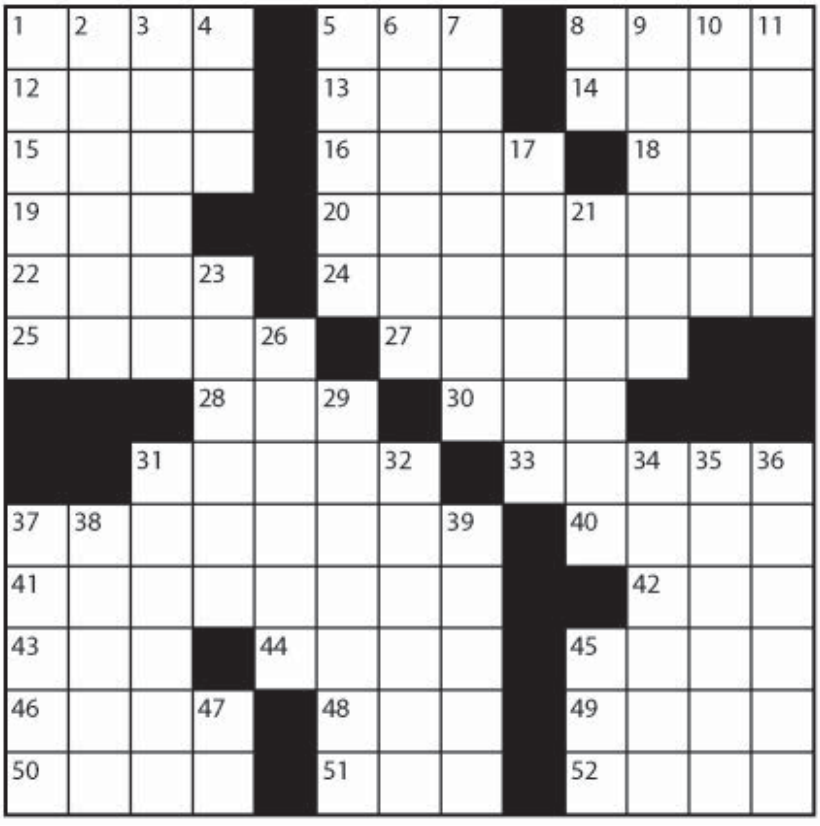
ACROSS

1 Ray-finned fish
5 Hospital unit
8 Border on
12 Yellow, vis a vis a banana
13 Yoruban Goddess of wind
14 Feeling
15 Good name for a painter using an electrical thickness gage?
16 Try out
18 Suffix for "ball" or "buff"
19 Large labor union representing stage performers
20 Piece of hockey equipment
22 Good name for a painter using a glove-like application device?
24 They're part of the strings section of an orchestra
25 Substitute
27 Good name for a painter using a pull stub for adhesion testing?
28 Muscular snake
30 Part of ITT
31 Good name for a painter testing for tensile adhesion?
33 Wham-O makes flying ones
37 Implicit meaning
40 Good name for a painter that leaves holidays?
41 The university milieu
42 Mouth: Comb. form
43 Feather's partner
44 Fashionable Christian
45 Good name for a painter helping to hold up a stage?
46 River that flows through Spain
48 Long-running NBC variety show, familiarly
49 Popular board game
50 Old TV standard established by the FCC
51 Freelancers send them out: Abbr.
52 Former GDR ally

DOWN

1 Beats badly
2 "Don't let them see that!"
3 Incorporate new information
4 Turkish chieftain
5 National hero of Bulgaria
6 Protector of the cornea
7 German war film directed by Wolfgang Petersen
8 Tech. students' kind of club
9 Removal of tissue for study
10 Subject of 7-down
11 Cultivates
17 Rang out
21 Arnold's older brother on "Diff'rent Strokes"
23 Garment with a knight's arms
26 Like paintings by Seurat
29 Theory involving indivisible elements
31 They're found in oysters
32 Points of the occipital bone
34 Nordic toasts
35 Event often known for its three rings
36 Volleyball player, at times
37 Like some breakfast cereal
38 Streaming service offered by Verizon
39 Those ranking above viscounts
45 Jesuit sch. in Ohio
47 Letters seen on a dashboard

(Answer next month)



Answers to last month's puzzle

M	E	O	W	E	D	■	S	Q	U	A	B	■
A	R	R	I	V	E	■	P	U	R	S	E	■
E	R	A	S	E	R	■	L	I	G	H	T	■
V	O	T	E	R	■	P	I	P	E	P	I	G
E	L	E	A	■	R	A	T	S	■	O	D	E
■	■	■	C	S	A	S	■	T	H	R	E	E
■	■	C	R	O	W	S	F	E	E	T	■	■
P	G	A	E	R	■	A	I	R	Y	■	■	■
F	U	R	■	C	A	G	E	■	P	V	T	S
F	I	S	H	E	Y	E	■	C	A	I	R	O
■	D	E	E	R	E	■	P	A	U	S	E	R
■	E	A	G	E	R	■	A	F	L	A	M	E
■	S	T	A	R	S	■	C	E	A	S	E	S

The Takeaway

By Karen Kapsanis
JPCL

Infrastructure: Age and Agendas

Infrastructure crisis. It is certainly a concern raised in the *JPCL* every month. This month, the costs of not maintaining our concrete infrastructure, which Fred Goodwin cites in "Concrete Maintenance" (pp. 34-46), are alarming. We pay in billions of dollars and innumerable hours for neglecting, for whatever reason, the roads, bridges, water treatment systems, and other facilities that we take for granted each day to get to work, get a drink of water, get through the day.

We are not alone in our concern. In mid-December, I searched for "infrastructure crisis" on the web and came up with "about 169,000,000 results." I certainly didn't read every result, but in the articles I read, I found a range of opinions and agendas. Politics as usual. Urgent problem. Federal concern. An issue for states and municipalities. An excuse to fund jobs with taxpayer money. Protection of our national interests. Hyperbole. Something in between.

I don't know your agendas, but I know mine.

One agenda is professional: I trust my authors and readers who tell me and show me the decaying structures around the country and argue for the need to maintain them.

One is personal: my safety and that of others.

- In Pittsburgh, our aged sewer pipes have released sewage into our rivers, contaminating them with bacteria I would rather not name, carrying diseases I would rather not contract.
- The approach ramp of the bridge I cross to get to my office slipped about 8 inches in 2008 because of corrosion affecting a rocker bearing. Fortunately, no one was injured. The detours and slowdowns during repair were annoying, but I preferred them to further degradation and its possible consequences.
- Last summer, during an exceptionally hard and sudden rain, a road about a mile from my house flooded severely: Four people drowned, according to local accounts, including three in a mini-van submerged in the nine-foot waters and one person who was swept into the nearby Allegheny river. Aged and inadequate infrastructure for drainage reportedly may have contributed to the accumulation of water from the flash flood. The area had flooded before, with not so dramatic results, but nothing had been done to fix it.

The word "crisis" holds a number of meanings, including "a crucial situation" and "a turning point." If we have a crucial infrastructure problem, be it national or local, let's take it as a turning point to change from neglect to constructive action.

In newer cities or cities with different designs, perhaps there is no infrastructure crisis. But from where I work and where I live, there is one, and we need to turn it around.