Going International

For the past several years, SSPC has put more effort into expanding our reach beyond North America. In August 2001, during our strategic planning process, the SSPC Board of Governors identified outreach to the global coatings market as an SSPC goal because we perceived the market's need for information, standards, and training. In light of that, the Board devised SSPC's Vision and Big Audacious Goal (BAG) in the strategic plan: "SSPC will be the worldwide acknowledged resource and authority for protective coatings technology and knowledge."

I am pleased to inform you of the progress we have made in achieving that vision. As noted previously in *JPCL*, SSPC launched a chapter in China, SSPC-C, in 2006. In 2007, we established chapters in Indonesia and Japan. We are excited about these efforts and will do our best to support these overseas entities. We are also very encouraged by the enthusiasm of the members of those chapters.

SSPC training has also moved outside the borders of the United States. Last year, we conducted five training sessions in Canada, two in Japan, two in Indonesia, one in Mexico, and one in the United Arab Emirates. While these numbers may be small in comparison to those of other associations, we see it as the first step down a long road. We are pleased about the acceptance of our courses throughout the international coatings community, and we have many more courses scheduled for this year. This increase in offerings shows that we are being recognized and are satisfying our customers' needs.

Another event that will assist SSPC in becoming a larger part of the global coatings community is the American Bureau of Shipping's (ABS) recent acceptance of our Protective Coatings Inspector Course (PCI). Whenever any outside agency recognizes and accepts an SSPC training course, the recognition is a great success. Two years ago, we received accreditation from the International Association for Continuing Education & Training (IACET) for our training courses. Last year, the American Institute of Architects (AIA), the American Board of Industrial Hygiene (ABIH), and the Florida Board of Professional Engineers (FBPE) gave us their endorsements. ABS's endorsement this year is enhanced by its stature as an international maritime classification organization. All of this recognition validates the training we are delivering to our customers and the courses we have in development.

Going international is a big step for this organization. With the industrialization of many countries around the world, the use of protective coatings will increase. We have a duty and an obligation as SSPC members and members of the global community to give those who conduct coatings operations around the world the information, knowledge, and training they need so that their projects are done correctly and safely, while protecting the environment in which we all live.

Bill Shoup
Executive Director, SSPC

Ian C. Sellars, 1938–2008; Was a Leader in Inspection Instruments

Ian Sellars, the longtime owner and managing director of Elcometer Instruments Ltd. in Manchester, UK, died suddenly on April 10 while out of the country. His company announced the news this week, noting that Mr. Sellars died peacefully in his sleep on an aircraft while traveling with his wife Nanette from India to Singapore.

A statement released by the company detailed Mr. Sellars' many accomplishments and his place as one of the founders of the modern coating inspection industry.

Mr. Sellars' earliest memory of the coatings industry was from the age of nine, watching his father make the first tool used in the manufacture of the very first gauge that bore the company name, the Elcometer 101. He began working alongside his father in 1958—where his first job was helping to assemble coating thickness gauges. In 1962, upon the death of his father, Ian Sellars, then age 23, took control of Elcometer. For nearly 50 years, he steered the family business from a small 32 sq m (370 sq ft) office employing 7 people into a global manufacturer and supplier of inspection equipment for the coatings and concrete industries. The company now employs over 200 staff in 6 offices and has a comprehensive global network of over 150 distributors.

Ian Sellars, 1938-2008

Under Mr. Sellars' direction, Elcometer won a Queen's Award for Export and a Queen's Award for Technical Innovation. During his tenure, the company introduced to the coatings industry and the world a number of firsts, starting with the world's first coating thickness gauge incorporating electronics (1963). Through Mr. Sellars' direction, the company also introduced the first coating thickness gauges incorporating digital technology (1978), microprocessor-based digital technology (1979), internal probes (1983), statistics capacity (1984), menu-driven technology (2000), and Bluetooth technology (2007).

Other technological innovations include the first single-probe ferrous/non-ferrous coating thickness gauge (1970); the first menu-driven, high-voltage holiday detector with integrated voltage calculator (2006); and the first digital surface profile gauge incorporating memory capacity and Bluetooth (2008).

It was Mr. Sellars' practice, the company said, to undertake at least one major tour of the distribution network and offices each year, and it was on such a trip that he died. He died doing what he most liked to do: travelling the world, visiting the company's distributors, and talking to customers about his company's latest products. The company statement summed up the feelings of those who knew Mr. Sellars. "He is a great loss to our industry and will be sorely missed by all who knew him."

Elcometer also announced that Mr. Sellars' son Michael, who has been working with his father for the past 13 years, will, with the help of Nanette Sellars, lead the firm and carry on his father's legacy.

PDCA OKs Concrete Painting Standard

The Painting and Decorating Contractors of America (PDCA) has approved a new PDCA Industry Standard, "Field Painting of Smooth Faced Tilt-Up Concrete." The purpose of the standard, P17-08, is to assign responsibilities to the various entities involved when smooth faced tilt-up concrete is field painted.

The standard is the 17th for PDCA. All are available for download on the PDCA "Member's Only" area at www.pdca.org.

Industrial Scientific Hires Global Director of Product Development

Industrial Scientific Corporation, a global provider of gas detection and monitoring instruments, systems, and related services, has announced the hiring of Scott Lordo to the newly created position of global director of product development.

In this role, Mr. Lordo will lead the product development process at Industrial Scientific. He will have direct responsibility for building a program office, with program managers responsible for the multifunctional execution of new product development projects. He will also lead the global coordination of engineering practices and standards.

Scott Lordo

Before joining Industrial Scientific, Mr. Lordo worked at Cattron-Theimeg, where he held the positions of senior engineering manager of rail solutions, application/development engineering manager, and most recently, director of program management. During his 12-year tenure, he was involved in the engineering integration of two corporate acquisitions, and in his most recent role was responsible for orchestrating product development projects across four global design centers.

Mr. Lordo is a graduate of Penn State University, where he earned both his BS in electrical engineering and an MBA.

ASTM D01 To Present Seminar on Low VOC, HAP Paints

ASTM Committee D01 on Paint and Related Coatings, Materials and Applications will present a technical seminar, "New Solvents and Formulating Techniques for Low VOC and HAP Paints," on Sunday, June 15, 2008, at the Hyatt Regency Hotel in Vancouver, BC, Canada. The seminar will be held in conjunction with the D01 Committee meeting to be held June 15–18 at the same location.

The purpose of the seminar is to discuss the state of the art in achieving quality products with the lowest possible volatile organic compound (VOC) and hazardous air pollutant (HAP) content.

The following three papers will be presented at the seminar.

- Solvent Selection and Formulation Practices for Low VOC and HAP Coatings—J. Douglas Booten, Eastman Chemical Company
- Film Forming Aid Selection to Minimize Volatile Organic Content—William Arendt, Versicol Chemical Corp., with Arron Strepka and Marakand Joshi
- Photochemical Reactivity—A New Paradigm for VOC Regulation—Ronald R. Hill, ExxonMobil Chemical Company

For more technical Information, contact Dr. William Golton, The Cecon Group Inc.—tel: 312-994-8000; email: wgolton@earthlink.net. For membership or meeting information, contact Jeffrey Adkins, Technical Committee Operations, ASTM International—tel: 610-832-9738; email: jadkins@astm.org.

RPM International Acquires UK-Based Flowcrete

RPM International Inc. (Medina, OH) has announced the acquisition of Flowcrete Group, a global manufacturer and marketer of resin flooring systems for industrial and commercial applications. Flowcrete, established in 1982 and headquartered near Manchester, England, has sales of approximately $85 million. Terms were not disclosed.

Flowcrete's range of decorative and high-performance flooring systems are sold to applicators, contractors, and end users under the Flowcrete, Flowfresh, Isocrete, Deckshield, and Mondeco brands. These flooring systems are predominately used in manufacturing plants, stadiums, schools, hospitals, parking decks, and other industrial or commercial environments that require lasting, decorative seamless systems.

Flowcrete will remain a stand-alone business under its current management team led by managing director, Mark Greaves. Mr. Greaves will report to RPM group operating president, Dave Reif, who said, "Mark's global vision for this business, coupled with his entrepreneurial operating philosophy, makes Flowcrete an ideal company to join RPM."

RPM International Inc., a holding company, owns subsidiaries that supply specialty coatings and sealants to both industrial and consumer markets. RPM's industrial products include roofing systems, sealants, corrosion control coatings, flooring coatings and specialty chemicals. Industrial brands include Stonhard, Tremco, Illbruck, Carboline, Day-Glo, Euco, and Dryvit.

Maintenance Tip

Project Managers Address Success

By Lori Huffman, JPCL

Effective project management is paramount to the success of a painting project. Here, four longtime project managers share their experience and perspectives on managing successful coating projects.

The Perils of Poor Project Management

A low profit margin, damage to a contractor's image, and liquidated damages are just some of the results of a poorly managed project.

When a project is not managed properly, work is delayed, and money is lost. Every day spent not working costs the contractor money in rented equipment fees, says Ernie Dunbar, project manager for Manta Industrial. The project manager must ensure a constant flow of work for a project to run smoothly. When the project comes to a halt repeatedly, the owner begins to question the contractor's ability to do the work. "[The owner doesn't] want to see you there any longer than you need to be," says Dunbar.

On public projects, mismanagement can lead to the payment of liquidated damages, which can vary from hundreds to thousands of dollars per day, says Dunbar.

Communication

"If you're not a good communicator, you can't be an effective project manager," says Mark Clara, vice president and project manager for Clara Industrial. The project manager has to keep close ties with the owner, engineer, inspector, and crew on the jobsite. On each job, Clara draws up a communications plan, which identifies who needs to be contacted and how often formal communication is necessary. Clara advises project managers to identify the areas of possible dispute early in a project, so that problems can be discussed and resolved in an amicable fashion. "It's easier to ask for things at the beginning of the job rather than at the end," he says.

Keeping an eye on the project on a weekly basis can mean the difference between profitability and disaster.

Mark Clara

Ernie Dunbar

Dave Crowston

Don Easter

Dave Crowston, senior regional manager for Vulcan Painters, Inc., advises weekly job site visits and urges project managers to compare budgeted spending to actual spending each week, so that necessary adjustments can be made.

Some of the projects for which Dunbar is responsible are located in different geographical areas, and he cannot perform daily oversight. Therefore, he says, maintaining a good working relationship with the site supervisor is very important. In addition, documentation of completed work by personnel on the jobsite can back up efforts at communication on a project, he says.

Multitasking Helps

Project managers in small contractor firms may need to wear many hats, working as the company's purchasing agent, project manager, and accounting personnel at the same time, says Dunbar, who has managed projects since 1987. The duties of project managers with larger companies may be limited to bidding on and running work, as is the case with Dunbar.

Planning and Organization

Project managers may juggle several projects at once, and organization is critical. The project manager must be familiar with the various specifications of each project, know the limitations of the products specified, and must document the details of each project so that the information is readily available, says Dunbar.

Having a good process for managing the project is one of the most important keys to success, says Clara, who has been managing projects for 12 years. The project managers in Crowston's company produce a control plan for each project, which outlines every aspect of the planned work. This plan is then made available to the owner, general manager, superintendent, and other parties to ensure that the painting contractor and the owner "are on the same page," he says.

When developing a work schedule, the project manager must set realistic goals, which comes down to working with the job superintendent, foreman, and subcontractors to develop an accurate estimation of how much time each portion of a project will require to complete, says Don Easter, project manager for Purcell Painting & Coatings. A project manager can set a baseline estimate for the tasks that need to be performed and then establish a sequence for the tasks. Once this is done, the project manager can review the work sequence to ensure that sufficient time and additional buffers have been factored into the schedule. These buffers can keep the project on target, and, more important, keep the work progressing smoothly without cutting corners to meet the schedule. By monitoring the project daily and weekly, the project manager can make adjustments, such as adding more workers to meet the schedule and not exceed the project budget. "You have to be inventive in the work you do, especially in industrial [painting]," says Easter.

Knowing what is needed on a project in regard to materials and equipment, and knowing when these items are needed to keep the project running smoothly affect a project significantly, says Dunbar. A project manager must develop a precise projection of spending on the project, looking at labor, equipment, and materials costs. Following up with the customer weekly to ensure that invoices are submitted on time is important to keeping a contractor's cash flow moving, says Crowston. Good estimating skills take years of practice to develop, says Easter, a fourth-generation abrasive blaster and painter who has managed projects since 1991.

Managing Risk

Risk management is another aspect of project management, says Clara. During a project, the contractor is bound by time limits, costs, specifications, and project scope. By identifying the risks involved in the project, with past experience as a guide, the contractor can prepare contingency plans that can keep the project running smoothly despite problems, he says. Two significant risks in most painting projects include the availability and quality of

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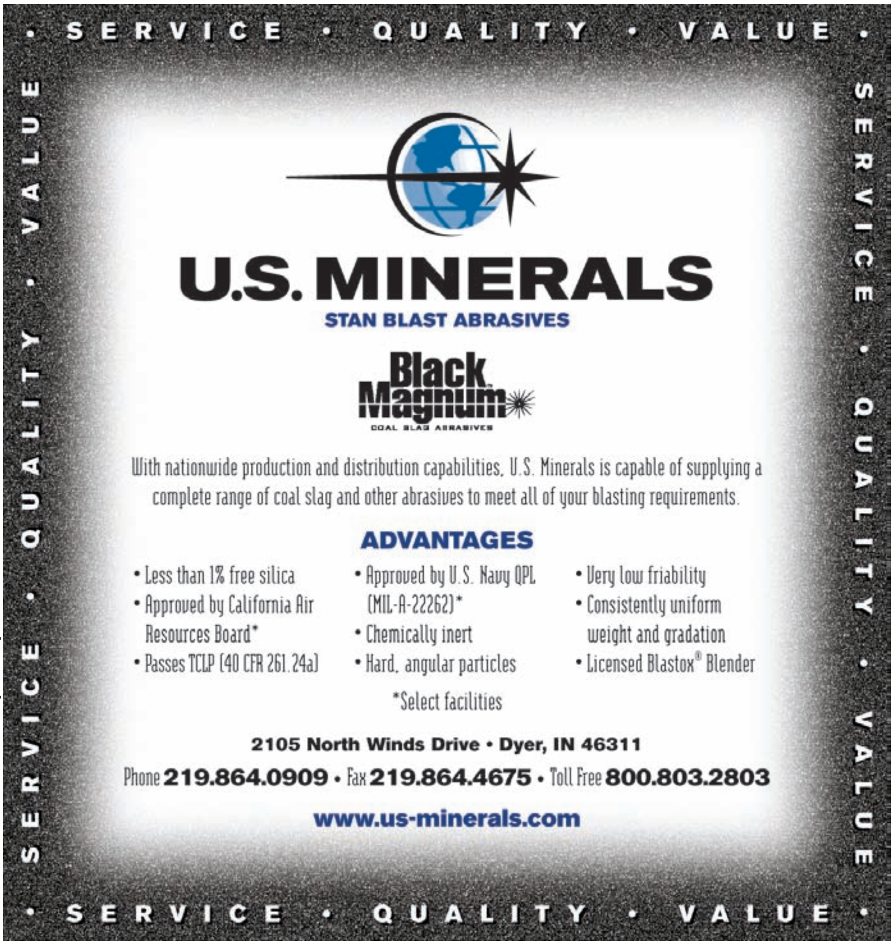

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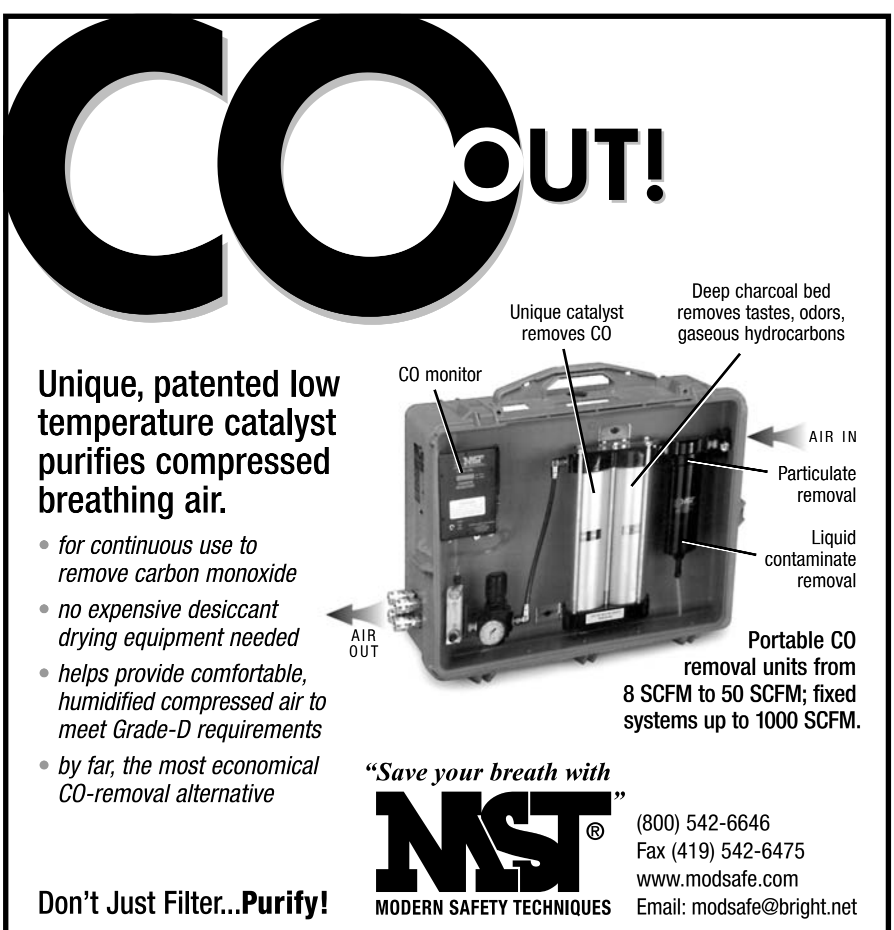

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labor and weather conditions. Project managers have to be prepared for labor shortages, which can be caused in part by inclement weather during a project. "If guys can't work, they'll leave a job," he says. "Painting is seasonal work. You can only keep people busy for part of the year, especially in Canada," he adds.

Keeping up with Regulations

"Part of the work I do is being knowledgeable about regulations," says Dunbar. Familiarity with regulations, including Federal, state, and local rules, is important in implementing a work plan. Dunbar's company employs a full-time safety director, who can be consulted on regulatory issues; however, a small company may require the project manager to keep abreast of all necessary regulations.

Staying on Top of Technology

"We look at technologies out there that may fit into a specific project. It's up to us to get feedback from different sources," says Dunbar. Project managers speak with paint companies and other contractors, and they attend trade shows searching for new ways to optimize their work.

Looking at various technologies as a means of optimizing costs on a project can give the project manager the advantage on low bid projects, says Easter. There are two approaches to competing in low-bid contracts: cutting corners to shave costs from the job or simply optimizing the tools available to do a better job with less money, he says. Owners will recognize a project manager's efforts to achieve a professional job. "If you're not on top of your game, you won't get the work," he says.

Computer technology has given project managers better tools for handling paperwork, says Easter. Project management has become digitized, with e-mail playing a large role in efficient organization and submittals. This trend has improved the productivity of project managers and has made planning projects easier. Easter refers to one project, where computer-aided conference calls facilitated the engineering and implementation of a complicated access and containment plan in three months, something that would have easily taken three years just a decade ago.

Computer programs can also help project managers stay on top of spending and productivity. Clara notes that his company uses a real-time cost accounting program that is tied to payroll and purchasing. When payroll is calculated, the program compares the project costs accrued by the contractor and the work performed to the budget and project schedule set by the project manager. When the project is completed, the program assesses adherence to the spending plans and schedules in each project phase. The project manager can then use this information to more accurately estimate similar projects in the future, Clara says.

Learning from Past Projects

The project manager should have access to a selection of work, environmental, and containment plans that are ready to be modified, says Easter. "You don't want to recreate the wheel." By keeping detailed, organized documentation of past projects, the project manager can use the records as a reference for similar work in the future.

"We rely on lessons learned," says Clara. In addition to referring to records of similar projects, he can consult other project managers in his company, he says. "We use a team approach here. I rely on others' experience and knowledge, and vice versa."

Differences and Similarities of Projects

Fundamentally, all projects require similar management skills from the project

Continued

Certification Opportunities for Project Managers

Project managers working in any industry, including construction trades, can pursue formal certification of their expertise through Project Management Institute, Inc. (PMI), headquartered in Newton Square, PA. Established in 1969, the organization has certified more than 267,000 Professional Project Managers worldwide.

Although the types of projects differ in various industries, project managers take the same basic steps to see a project through to completion, says Joe Patterson, manager of public relations for PMI. With more than 20 million project management practitioners worldwide, having a means of validating professional claims is critical, he says.

PMI offers a variety of certification programs, including the Project Management Professional (PMP) program, which is the most globally accepted certification in project management, says Patterson. Candidates for PMP certification who have college or university degrees must have a minimum of 4,500 hours of project management and at least three years of project management experience within the past six years to qualify for the certification program. Candidates without college degrees need to have spent a minimum of 7,500 hours managing projects and to have worked as project managers for five of the past eight years. In addition, all candidates must complete 35 credit hours of project management education, he says. Once certified, Professional Project Managers maintain their accreditation by completing 60 professional development units every three years.

For more information about PMI and its certification programs, visit www.PMI.org or call 1-610-356-4600.

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manager, says Crowston. His company is certified to ISO 9001, which requires the contractor to initiate and follow a control plan for the work, no matter what size the project. Small projects may require less supervision than larger projects; however, the value of any project can be lost without vigilance on the part of the project manager, he says. In some cases, the project manager may "pass the baton" to the superintendent on a small project, briefing the superintendent on the plan and the budget, says Easter. "When [a project is] over $100,000, a project manager gets more involved. When a project [is valued at more than] $500,000, the project manager becomes very important to the success of the job," he says. These jobs typically call for the project manager to work with design engineers, to manage subcontractors, to manage the project superintendent, to deal with the owner, and to handle payments and cash flow on the job.

A small project can be thought of as a microcosm of a large project, says Easter. Large projects can be more intricate, requiring more detailed schedules and budgets, in addition to a greater volume of paperwork, such as a larger number of weekly time sheets. However, success in larger projects can be achieved by breaking these jobs into a number of smaller, more manageable tasks, he says. In once instance, Easter broke a large bridge project into four smaller projects, each with its own team of workers. These teams were then given incentives for performing the work in a timely manner, he says.

Maintenance and new construction projects can differ in their time constraints, says Dunbar. A new construction project will usually have a set amount of time allotted to complete the project, and a painting contractor will likely have to conform to the scheduling demands of the general contractor. Maintenance projects may not be as time-sensitive, says Dunbar. For each project, a project manager needs to look at who is working there, what time constraints the project imposes, and how communication can facilitate the work, says Dunbar.

Demands on the project manager can differ between private and public projects. On public projects, owners are more likely to give contractors step-by-step instruction, whereas private projects are more likely to rely on the expertise of the contractor, says Dunbar. Contracts with private businesses may not include rigorous inspection and do not typically require the contractor to follow the submittals process common with public projects, says Easter. He cites one public project that required 32 submittals to be prepared by the project manager.

Striving for Continuous Improvement

Improving the quality, safety, and productivity of projects should be a top goal of any good project manager, says Clara. At the conclusion of each project, his company holds a closing meeting to review the job and assess whether the contractor met its expectations for quality and safety. Areas that need improvement are identified, along with strategies for achieving these tasks. When the next job begins, the contractor already has a good start on improving its processes, he says.

Honing Project Management Skills

Aside from learning on the job, one way to become a better project manager is to receive training and certification from independent providers, says Clara. He recently completed the process of becoming a Project Management Professional (PMP) through study with the Project Management Institute (PMI), a non-profit organization headquartered in the U.S. (See sidebar, p. 11.)

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by Daniel J. Zienty, Short Elliott Hendrickson Inc.

Sending the Right Signals:

Project Management for Telecommunication Sites on Water Tanks

More than a decade has passed since the Telecommunications Act of 1996. Wireless communication is now a mainstay in our lives. Mergers, acquisitions, and technological advances in the telecommunications industry drive the need for new telecommunications sites and equipment upgrades.

When it comes to telecommunication sites, industrial structures and protective coatings play a supporting role. In fact, over the years, construction of telecommunications sites on municipal buildings and water storage facilities has become commonplace. Installations and upgrades of telecommunications sites, from the planning phase to activation, can extend over several years. Careful planning to contend with extreme ambient conditions—on either side of the spectrum—during construction has become a standard in the industry.

Even greater difficulties can arise when water storage facilities with installed antennae require reconditioning. Municipalities should address important considerations up front, including whether tenants' attachments will be removed or included as part of the overall painting project. Addressing these case-by-case complexities during the planning phase will minimize problems during the project and ensure a successful outcome for all parties involved.

Fig. 1 (Facing page): Regardless of the type of tank, correct routing of the coaxial cable and attachments are critical to future maintenance of the tank coating. For this tank, the routing pattern is correct, with galvanized attachments to the support column. The cable is then routed underneath the catwalk, not on the handrail. Photos courtesy of the author

Planning for New Telecommunications Site Construction

In new construction, planning begins when a city receives a formal construction application from the proposed telecommunication tenant. Next, the tenant's project engineer conducts a site walkthrough with city staff or city representatives to develop a comprehensive set of plans. When engineers design an installation on a water storage facility, the style of the tank plays a major role in determining the routing and method of equipment attachment (Fig. 1).

The best antenna installations are those that are kept simple. In keeping with this philosophy, telecommunications installations should be designed to achieve the following goals.

- Protect the functionality of the site
- Minimize damage to the tank and existing coating systems
- Minimize negative aesthetic effects
- Minimize the effect on daily tank operation and maintenance (Fig. 2)

The following key questions from a coating perspective should be asked.

- How recently was the tank painted?
- What type of coating system was used?
- Who was the coating manufacturer?

How recently a tank was painted or was scheduled for reconditioning is an important consideration because this information will determine the type of attachment method to be used for the antenna mounts. For example, if a ground storage tank has been slated for reconditioning within a two-year period, mounts should be permanently welded to the tank. Areas damaged during welding, especially immersed areas, can be properly repaired during reconditioning. Conversely, if the tank has been painted recently, engineers should consider bolting, capacitor stud-welding, or other attachment methods to minimize damage to the newer coating system.

Fig. 2 (above): By keeping the coaxial cables together and aligned opposite the ladder in this tank tower, the cable installers preserved access to the tank for maintenance or other needs.

During the tenant's conceptual planning period for the attachment of telecommunications equipment, the water authority should immediately notify the tenant of any proposed facility maintenance. A tenant may elect to delay construction or coordinate it with tank reconditioning. A choice to delay or coordinate means the tenant can save costs associated with temporary removal and replacement, and the tenant's engineers can have additional time to complete the design and to modify it to incorporate future tank maintenance work. Tenant agreements are often developed in concert with construction plans, and language can be included in the lease that addresses future maintenance as well as third-party plan review and inspection services.

Whatever direction the tenant takes, the existing tank coating system should be properly identified to determine compatibility with the attachment's new coating and to prevent coating failure. Providing records about the existing paint system and manufacturer to the tenant's design engineers will help them get a better color match between the tank coating and the finish coat for the attachment. Before a city gives final approval to the coating plan, a city's engineer should request a color drawdown (sprayed sample) from the manufacturer of the coating for the attachment. Older coating systems tend to lose their gloss, and this condition may necessitate a change in tinting or overall color selection for the attachment.

For installation components that require painting, specifications should be written to include application in a shop. Shop painting ensures a controlled environment for surface preparation and painting operations in accordance with

Editor's Note: This article is based on a paper presented at PACE 2008, held January 27-30, 2008, in Los Angeles, CA.

the paint manufacturer's recommendations and can simplify the inspection process for the city's engineer (Fig. 3).

Because they require welding, antenna attachments and coaxial cable penetrations are the major contributors to paint touch-up, which is a weather-sensitive issue in the installation process. Attachments also add to the list of weather-sensitive issues related to coating work:

- touch-up painting around coax penetrations and other weldments,
- painting coaxial cables,
- painting the antennas, and
- restoration of the tank site.

Again, when possible, the tenant's engineers should consider alternative methods of antenna and coaxial routing attachment. A change in means and methods can save the tenant time and money by reducing potential damage to the tank during installation, compressing the project schedule for weather-sensitive tasks, and more effectively completing open punch list items.

Fig. 4: This galvanized antenna attachment on a water tank handrail eliminates damage to the paint and requires minimal maintenance.

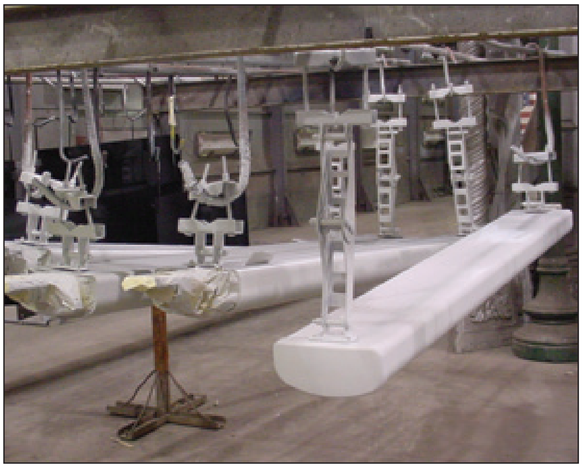

Fig. 3: Shop painting antennas allows for a coating work in a controlled environment and facilitates the city engineer's inspection of the work.

Tenant discussions should also include installation of materials that are not corrosive and do not require protective coating. These materials include galvanized and plastic materials (Fig. 4).

The concern for the schedule and the promotion of non-painted products often carries over into the use of coaxial cable. On legged and ground storage tanks, visibility and color can become issues. The plastic outer covering on coax does not lend itself well to painting; premature flaking and peeling occur even with quality workmanship. Designers should consider manufactured colored coaxial cable, which has been used successfully in a number of projects. Coaxial cable is readily available in white and gray, which blends well with most common tank colors (Fig. 5). This alternative not only eliminates upfront painting and has a positive effect on the project schedule, but also reduces future maintenance issues.

Planning Tank Reconditioning

At some point, a city's water storage facility will need reconditioning. Water tanks with multiple tenants and antenna installations can add numerous complications to a reconditioning project. Though many lease agreements require tenant notification of as little as 30 to 90 days, the sooner the tenant is brought into the project planning process, the higher the probability for a successful project.

Whether the project is developed in-house by a city or by a contracted engineering firm, the first step in planning is to review the lease information associated with that facility. As installations may reflect different tenants, sited over many years, the terms related to individual tenant/landlord (city) responsibilities may differ.

Lease language important to the project includes the following.

- Project notification
- Protection of lessee equipment
- Pre- and post-testing of equipment
- Temporary removal
- Temporary sector shutdown
- Equipment (antennas and attachments) painting

Planning for and completing a tank reconditioning, by following a design/bid/build process (evaluation through painting), can take 12 months or more. Therefore, tenant notification and a planning meeting should be scheduled following review of the lease.

At a minimum, tenant notification should include identification of the project site, project scope, and contact information. In addition, references to specific paragraphs of the lease agreement that identify the above points should be included.

Those persons invited to the planning

meeting should include representatives of each tenant. This may include the installation contractor, city staff, and the city's engineer. Because a reconditioning project is not only a large maintenance expense to the owner, it also can present the following major costs to the tenant.

- Temporary removal and mobilization of a portable telecommunication site known as a Cell-on-Wheels or C.O.W.
- Temporary shutdown
- Internal management and coordination
- Painting

However, a properly planned reconditioning project can result in a win-win outcome for both the city and the tenant. In the case of an equipment upgrade, conditions during the original installation may have required a detachable method of attachment such as capacitor stud welds. Also, because standard components as well as placement and routing of equipment have evolved, an opportunity for a better installation may now present itself.

Fig. 5: On the roof of a ground storage tank, this manufactured, colored coaxial cable installed over a shop-painted mount (on the left) will have a longer service life than a painted cable. Note that the studs holding the bracket have white plastic caps that prevent rusting. Holding the cable on top of the mount is a galvanized z-bracket.

In many cases, the installation of telecommunications equipment on water storage facilities adds time and cost to the project. The painting contractor may require additional labor to carefully and safely conduct abrasive blasting and painting operations around brackets, coaxial cables, and antennas. The surface prep and coatings work can be further complicated if installed equipment protrudes from the tank in a way that interferes with the operation of the painting contractor's containment system. To assist a city and its potential tenants in identifying these costs, the tenant's engineer should consider breaking out specific tasks on the project bid form, including the following.

- Protection of telecommunications equipment
- Painting of telecommunications equipment
- Exterior surface preparation and painting (equipment in-place)
- Exterior surface preparation and painting (equipment removed)

The cost difference between leaving the equipment in place and removing the equipment represents an additional labor cost associated with the project and is passed on to the tenants.

Finally, the tenant may elect to temporarily remove its equipment and erect a C.O.W. to maintain consistent service throughout the project, even if the lease does not take temporary service into account. A meeting and site walkthrough soon after notification provide each tenant with the necessary lead time to set up a temporary system or plan for any site upgrades before mobilization by the coating contractor. Upgrades related to changing out antennas may be minor. However, upgrades may include an opportunity to properly seal or reset weld brackets by aligning them on the inside face of the support column on legged or elevated tanks. Additional options include the opportunity to change out coaxial cables and replace them with maintenance-free manufactured-colored cables that are more aesthetically pleasing as well as more cost effective over the long term.

Summary

Telecommunications installations are an integral part of our everyday lives. For many communities, their existence on local water tanks and other city-owned infrastructure can provide a city with additional revenue. However, for tanks and telecommunications equipment to harmoniously coexist, it is important that functionality be maintained for both the telecommunication site and the water tank. To successfully achieve this result, a well thought-out planning process that aligns the needs of both the tenant and the city is key to a win-win proposition. This process calls for solid design, low costs, and good timing for both parties. Whether it is a new site construction or a reconditioned tank, antennas and water tanks can coexist.

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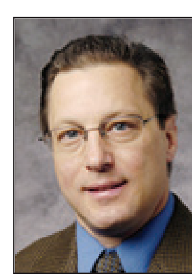


Steel Bridges: Corrosion

by Eric S. Kline, KTA-Tator

Although bridge construction extends back thousands of years, steel bridge painting is in its infancy. The first iron bridge was built in 1779, and the first steel was used in a bridge in 1828. Coated bridges from the 19th century survive, raising the question, "Can coatings protect steel bridges for the next hundred years?" This article briefly reviews bridge construction, along with the history of bridge painting. The author discusses how to achieve 100 years of service life using current materials and offers recommendations for improving steel bridge painting.

A Brief History of Bridge Construction and Painting

Wood and Stone Bridges

For thousands of years, it is likely that bridges only a few feet long had been constructed of stones, logs, or tree trunks. One of the most unusual bridge stories, from an account by Herodotus, the ancient Greek historian, relates to the invasion of Greece in 480 B.C. by the Persian King Xerxes. He had his army construct a mile-long "pontoon bridge" across the Hellespont to invade Greece. That bridge was made of wooden planks laid across cables supported by more than 600 wooden boats lashed together with ropes.

Wood bridges served an important function, but their service life was limited, as was their ability to span long distances. Even larger, complex wooden structures (like the bridge over the River Kwai in World War II) were limited in individual span length. More important, these structures were eventually unable to resist the forces of nature and were destroyed by fire or rotting.

Another form of bridge was the basic stone structure. A stone bridge of unknown origin at Tarr, England, is made of stones carefully piled on other stones across the Barle River. While complex, stone bridges surviving, like those constructed before and during Roman times, could not span wide expanses. Bridge construction was therefore limited to locations where the topography allowed points of support that could be placed relatively close together, usually no more than about 100 ft (30.5 m).

Though none survive, it is believed that most of the bridges from Roman times were constructed of timber. The most famous surviving Roman "bridges" are those used in the aqueducts and are constructed of the characteristic circular (Roman) stone arches.

Editor's Note: This article is an abbreviated version of a paper the author presented at the National Steel Bridge Alliance's (NSBA) 2007 World Steel Bridge Symposium on December 6, 2007, in New Orleans, LA. The article appears here with the permission of NSBA.

The Modern Era of Bridges

The era of the modern bridge began with the development of iron and steel, strong

Protection for 100 Years

The Brooklyn Bridge, a steel suspension bridge completed in 1883, is in its second century. Photographer: veni

materials that would enable bridges to efficiently span long distances. Steel raised the issue of corrosion protection as a durability consideration.

Iron Bridges

With the advent of iron production in 1779, cast iron structural members were possible. The properties of cast iron made it ideal for certain types of structures. Because cast iron is strong when compressed (having compressive strength) but weaker when stretched (low tensile strength), cast iron bridges and bridge elements tended to be in shapes like arches, where the forces are mainly compressive. The first cast iron bridge was built in Coalbrookdale, England, in 1779.

The development and use of wrought iron occurred in approximately 1790, just after the first uses of iron in bridges. Wrought iron is a specially worked form of iron that is strong when stretched (having tensile strength). By approximately 1800, the development of wrought iron made possible its use in bridge components that required tensile strength. Cast iron and wrought iron or combinations of the two were the materials of choice for iron bridges from about 1779 to the 1840s. Both cast iron and wrought iron were resistant to corrosion.

Steel Bridges

The steel era in bridge construction actually began in the early 1800s while most bridges were still being built of cast and wrought iron. Steel was first used in a 300-foot (91-meter) suspension bridge built in 1828 in Vienna, Austria. In 1828, however, steel was produced in small batches. The batch process had several aspects that limited the more widespread use of steel in bridges. First, batch processing meant that steel was produced in limited quantities. Second, the steel varied from batch to batch in properties. Finally, batch processing meant that steel was expensive. It is not known what means of corrosion protection was used on the first steel bridges.

The 1850 invention of the Bessemer process for making steel yielded a more plentiful and less costly material with improved properties. Thereafter, steel began to emerge as the material of choice for the construction for bridges. The Eads Bridge in St. Louis, Missouri, still in use, was constructed with steel arches in 1874. Shortly thereafter, the first steel arch bridge in Europe, the Maria Pia Bridge in Portugal, was completed in 1877. The construction of New York City's landmark Brooklyn Bridge, an iconic suspension bridge, followed in 1883. The Firth of Forth railroad bridge, a massive steel cantilever bridge in Scotland, was completed in 1890.

Unlike iron, steel requires corrosion protection.

Lead and Chromium Compounds as Early Corrosion Inhibitors

While steel has been used in bridges for only about 125 years, corrosion protection of the steel has been recognized as a concern for that entire time. Most of the history of coating steel bridges for corrosion protection can be summarized in one phrase: "lead-based paint." The use of lead and chromium, both heavy metals, as pigments in paint to protect steel bridges appears to have been well established by the time the Firth of Forth rail bridge was built.

Further, both the Eads (1874) and Brooklyn Bridge (1883) were painted with lead-based paint, as were most steel bridge in the U.S. until around 1970. Among other things, lead-based coatings were inexpensive, did not require extensive mixing and agitation, and were easy to apply. Even in 2007 dollars, costs would probably be between $0.50 and $0.75 per square foot. Although dispersion of the pigment in long oil binders (e.g., linseed, flax, and fish oils) did require some effort, it was easily accomplished with simple tools available to virtually all painters.

Lead-based coating materials could be applied to surfaces under a wide range of circumstances, from very dry to semi-damp. Importantly, the coating was able to "wet" the steel surface and adhere well to mill scale-covered surfaces. When repainting was required, the material could easily be recoated with itself. In fact, it was commonly believed that "the more paint, the better," because it was the lead pigment that provided the corrosion protection. This belief was actually true, until the coating thickness measured around 30 to 50 mils (750 to 1,250 microns). (One mil is 1⁄1,000 of an inch; a dollar bill is about 5 mils thick.) After decades of exposure to the elements, the alkyd and linseed oil binders would begin to dry out, oxidize, embrittle, chalk, erode, and generally deteriorate. When these binder materials deteriorated to the point where the cohesive strength of the coating was exceeded by the tensile forces, the coating spontaneously delaminated. At these higher thicknesses, the coating was subject to disbonding from itself, the substrate, or both.

Wood was one of the materials used on the earliest bridges. Photographer: da-kuk

The lead- (and chromate-) pigmented coatings could be applied to minimally cleaned surfaces. The normal required cleaning consisted of solvent cleaning followed by hand- or power-tool cleaning, either of which removed only loose contaminants before coating application. Intact mill scale remained on virtually the entire steel surface. The oil binder carried the inhibitive lead and chromate pigments into cracks and crevices of the mill scale to the steel, where they passivated and protected the steel from corrosion.

In coastal or marine exposure conditions, oil- and lead-based paint would last for as few as five years before touch-up was needed; however, in milder environments, the coatings could last for decades. At least one-third of the United States lies in mild weather zones, where these coatings would be more than adequate for decades.

Despite all of its strengths as a coating material, this means of protecting steel from corrosion began to end in the U.S. in the 1970s when the legislators and Federal regulators began to recognize the environmental and health risks from lead and chromium pigments in paints and other substances primarily when the lead paint was applied or removed, not when it was intact. But by the 1970s, protective coatings for bridges had already begun to change.

The Recent "Era" Steel Bridge Coatings

Around 1970, many state highway departments switched to a completely new approach to protecting steel bridges from corrosion. The approach included much more expensive surface preparation and the application of a three-coat, high-performance system consisting of a zinc-rich primer followed by two vinyl coating layers. The most important change was that the new system required the complete removal of all mill scale from the surface of the steel. Shop painting required the use of labor-intensive open-nozzle blast cleaning or the acquisition of expensive centrifugal blast cleaning equipment. Cleaning costs alone—$1.00 to $1.25 per sq ft—more than equaled the entire as-applied cost of the earlier systems.

On the cleaned steel surface, the tiny metallic zinc particles of the primer could be in intimate, metal-to-metal contact with the steel substrate, and thereby create an anode-cathode relationship. Zinc, as the anode, would be sacrificed in a slow reaction, which produces harmless by-products, and the cathode (steel) would be protected. The two coating layers applied over the zinc-rich primer protected it from the surrounding atmosphere, thereby extending the primer's ability to provide long-term protection to the steel beneath.

In a landmark article in the *JPCL* in May 1985, Leyland surveyed all U.S. state highway departments, asking them to identify the coating systems they used on new steel and in maintenance applications. He also asked for their general thoughts about the systems they were specifying. Leyland's survey revealed that while modern era high-performance coating systems were used at that time in about half the states, the other states were using the lead- and chromium-based systems, mostly for maintenance painting. Leyland's research revealed that, at that time, the states used two coating systems predominantly: a basic lead silico-chromate system and the newer, three-coat system composed of an inorganic zinc-rich primer with a vinyl mid-coat and vinyl topcoat.

The changes noted by Leyland signaled that the end was near for lead and chromium pigments in bridge coatings used for either new construction or maintenance painting. Less and less of the material was used on steel bridges, and currently, little, if any, lead-based paint is applied.

Current bridge coating technology has changed incrementally since about 1970. Corrosion protection of a steel substrate is rooted in the use of a zinc-rich primer. Because of air pollution issues related to their solvent content, the two vinyl coating layers whose use Leyland noted in 1985 have largely been discontinued on bridges.

Aqueducts, made of stone, are the most famous surviving bridges from the Roman empire. Photographer: Tomazi

Topcoat materials have evolved and are chosen for properties such as their durability, aesthetics, edge retention, color, and compliance with air quality regulations. Currently, the systems commonly in use involve a zinc-rich primer with an epoxy mid-coat and a polyurethane or polyaspartic topcoat; a zinc-rich primer with an epoxy mid-coat and a fluoropolymer or polysiloxane topcoat; a zinc-rich primer with a waterborne acrylic mid-coat and topcoat. Other systems consist of all acrylic coatings; and some consist of lead-free and chromate-free oil alkyd coating materials. Still other systems use multiple coats of calcium sulfonate-containing materials. (For details and cleaning specs, see *Volume 1 Good Painting Practice* and *Volume 2 Systems and Specifications* published by SSPC: The Society for Protective Coatings.)

How Long Do Systems Last?

NTPEP Testing of Coating Systems with Zinc-Rich Primers

In about 2000, the American Association of State Highway and Transportation Officials (AASHTO) initiated a coatings testing program under its National Transportation Product Evaluation Program (NTPEP). Paid for by the paint suppliers and performed by an independent laboratory, the program consists of an extensive series of tests in accordance with Specification R31, "Evaluation of Coating Systems with Zinc-Rich Primers." Test results are available online, so that departments of transportation (DOTs) can access the data as well as decide which materials "pass the bar" and are included in specifications or on Qualified Products Lists (QPLs). The program eliminates the necessity for every DOT to test each material.

Service Life of Zinc-Rich Primer-Based Coating Systems

The service life before first touch-up of the high-performance systems using a zinc-rich primer is about 30 years, in most circumstances. However, even in the northern tier of states that heavily use roadway deicing materials, many structures coated in the early 1970s are in very good condition and are only now even beginning to approach the time for their first touch-up. The first touch-up includes repairs to extend the service life of the topcoat.

The service life of a zinc-rich primer is limited only by actions that scratch, perforate, or damage the topcoats and, in doing so, pierce, remove, or expose the zinc layer. This process causes the zinc to react by sacrificing itself to protect the steel beneath. The reaction creates white powdery byproducts that often will cover the reaction site in a self-healing process. As long as the layers of coating over the zinc-rich primer are periodically maintained, the full service life of a system in the field has yet to be reached. With periodic field maintenance, a zinc-rich system with any of the available mid-coats and topcoats should be able to match or exceed the extended service life of 100 years provided by its predecessor, lead-based paint.

Cost Concerns with Zinc-Rich Systems

Significant upfront costs are associated with the use of a shop-applied, three-coat system consisting of an inorganic or organic zinc-rich primer and two other coating layers. The time and space required for proper shop application of a three-coat system make painting unattractive to steel fabricators, who are subject to tightening schedules and demand for accelerated bridge construction by owners anxious to meet project deadlines. The dry-to-handle time required between coating layers, often 24 hours, also causes steel members to be moved within the shop multiple times. Excessive moving of often large, heavy steel members in the shop is inefficient and expensive.

The cost of removing mill scale is also high. Centrifugal blast cleaning machines efficiently remove mill scale, but they cost approximately $500,000 or more and require continuous maintenance. Consequently, cleaning costs alone in most shops are thought to be around $1.00 to $1.25 per sq ft. The cost of the zinc-rich primer and the two layers applied over it can be as much as $0.75 to $1.00 per sq ft (material costs only). When application and overhead costs are included, a properly cleaned and fully coated steel bridge member could cost as much as $3.00 to $4.00 per sq ft when it is ready to ship to the field.

Extending the Life of Old Bridges

Problems associated with old bridges are related to lead paint management. Since the decision in the early 1970s to discontinue the use of lead-based paint, DOTs have two basic approaches to management: remove the entire aged system and replace it with a new system, or repair it following an engineered maintenance painting approach. The decision to repair or replace an aged system is a crucial one in terms of the life-cycle cost of the bridge's corrosion protection system.

The engineered approach, the logical and most economical strategy, is to maintain the coating on the structure in a serviceable condition, extend the service life of the existing coating as long as possible to reduce life-cycle cost, and postpone the expensive removal and replacement of lead-based paint.

In other words, the engineered approach is to manage the life of the coating system by touching up the paint before it needs to be removed on a wholesale basis. It means painting the structure "before it needs painting," so that the areas that are corroded can be managed and minimized. In doing so, the service life of the lead-based paint that is in place and protecting a vast majority of the structure's surface area can be effectively extended. An effective service life extension, often measured in decades, is possible in some cases. Regulations do not require that lead-based paint be removed. Until it must be removed for good reason, such as when the coating is very thick, poorly adherent, and corrosion is present over more than 16% of the bridge, lead-based paint can remain in place. Above that 16%, efforts to repair the coating may be counterproductive, and the structure should be scheduled for complete coating removal and replacement.

Employing an engineered maintenance painting approach means going "against the grain," since a traditional bridge painting strategy is to wait until the paint on the bridge is beyond its service life and in poor visual condition before recognizing a need to repaint.

Proper removal of lead paint is costly. Blast cleaning itself is costly. Not only must contractors remove layers of lead paint, but also they generally must remove old mill scale to create a suitable surface for recoating. The amount of blast cleaning increases costs. In addition, to prevent lead debris from conta-

The Clifton Suspension Bridge, completed in England in 1864, originally used cast iron suspension chain, which was replaced with steel cable. Photographer: Nickos

Another Unknown: The Effect Of Changing VOC Target Limits On Coating Performance

Changes in volatile organic compound (VOC) requirements generated by the Clean Air Act of 1970 and its amendments (e.g., 1977, 1990) influence the selection of coatings. The Clean Air Act Amendments mandate a maximum of 450 g/L of VOC for industrial maintenance coatings. Various other target limits exist as well. The Northeast Protective Coating Committee (NEPCOAT) member states use a limit of 340 g/L for approved coatings. California's South Coast Air Quality Management District leads the way in environmental conservation, using a VOC target of 100 g/L. In the past, other California VOC targets have spread across the country.

Meeting VOC requirements has meant that coating manufacturers have reformulated their coatings to remove and replace solvents with other technologies. A new array of waterborne, high-solids, and other high-performance coatings is being developed by coating suppliers. These coatings are being tested via the NTPEP or other protocol. This new generation of coatings represents materials that do not have the 35-year field history of the solvent-based epoxy systems first used in the early 1970s. The new materials may perform better, worse, or about the same. After extensive testing via NTPEP, NEPCOAT, or other protocols, coatings suppliers are confident that the performance of these reformulated coating materials will be the same and quite likely better.

The Eads Bridge in St. Louis, MO, completed in 1874, with painted steel arches. Photographer: Three Jays

minating the environment, contractors must install temporary containment structures for capturing the abrasive and lead debris, then have it treated, prior to disposal, all adding to the cost of total removal. Also raising the cost is the fact that blast cleaning crews inside a lead-contaminated containment require respiratory and other protective gear. With all of these factors, the cost of painting lead-coated bridges has increased to approximately $7.50 to $25.00 per sq ft, depending on, among other considerations, location, access, and height of the bridge above the ground. The cost to access the steel surfaces during repainting adds to the cost of painting in the field. In addition, it is frequently necessary to prevent any paint overspray from being emitted from the containment during painting operations at the field site.

If maintenance repainting of old lead-coated bridge steel is able to be performed in the shop, many of the complications and expenses of field operations are obviated, but additional erection and transportation costs are incurred when removing, transporting, and then re-erecting the bridge members.

The development and employment of an effective engineered approach to the maintenance and repainting of existing steel structures is not frequently undertaken. Yet surveys of bridges and their condition exist and can be used to help determine when an engineered maintenance approach can be used to extend the service life of the existing coating system rather than remove the system prematurely.

Areas Requiring Research or Re-Examination

To be able to routinely achieve 100-year coating service life, research is needed in the following areas.

• *Determine the Service Life of Zinc-Rich Coating Systems in Place*
Coating durability is always the first thing that comes to mind. One may ask, "If paint is so good and lasts so long, why is it that we have to repaint every 8 to 10 years?" The reality is and has been quite different for a long time. Since the coating revolution in the 1970s, there have been literally hundreds of thousands of tons of steel bridges painted with zinc-rich systems. These bridges are now approaching 40 years of age and are, as a rule, in good condition. As noted earlier, some bridges may need touch-up of the topcoat or even require the application of a skim coat over the topcoat. Thereafter, they will be able to easily last another long period before needing attention again. At that time, if the zinc-rich primer is undisturbed, the age of the coating could be approaching 55 to 80 years, while still intact and protecting the steel substrate. At this point, 100 years of service is well within reach. (SSPC has a chapter in *Volume 1 Good Painting Practice* devoted to expected service life of coatings systems.)

• *Inexpensive and Durable New Coatings*
Often paint industry insiders complain that, "We could solve the problem, but it is going to cost more."

Reflecting on the development of steel bridge painting over the last 125 years, the technology of corrosion protection gravitated toward the "lowest common denominator." For example, lead-based paints were likely the corrosion-inhibitive coatings of choice because they were both effective and inexpensive. Research should be undertaken to find or develop such an inexpensive, easily applied, long-lasting (but non-toxic) coating material to replace lead.

• *Making Steel Bridge Painting the Obvious Choice*
In about 1999 or 2000, the first major change in the three-coat system of the 1970s came about in response to the challenges presented by the necessity to fully contain overpass bridges during lead paint removal and repainting operations. Since roadways had to be closed to clean and paint these structures, it was believed that significant savings could accrue with the development of a fast-curing, two-coat system. The two-coat system could be applied over blast-cleaned steel and would deliver the same protection to the steel surface that a three-coat system would provide. Since then, various materials have been developed, tested, and offered to the bridge painting community. In 2004, a two-coat paint system was approved by North East Protective Coatings Committee (NEPCOAT).

Additionally, since the two-coat system approved by NEPCOAT cures quickly, in about one hour, its use in the field during maintenance repainting of steel bridges in either daytime or nighttime allows bridges to be repainted with fewer or perhaps no daytime lane closures.

In the shop, the two-coat system's use should increase shop through-put because the time spent simply drying is dramatically reduced.

According to data on shop painting costs that Appleman collected for a Federal Highway Administration-(FHWA) funded study, the cost to abrasive blast clean steel to remove mill scale and to apply a three-coat system in the shop is about 11 to 12% of the total cost of newly fabricated bridge steel. Blast cleaning and primer application alone cost about one-half that total, or 6%. By inference, it appears that the use of two coats of paint in place of three can reduce the cost of fabricated bridges by approximately one-half the difference or about 3%. A 3% savings in the total cost of the fabricated steel bridge member is substantial. For example, on a one million-dollar bridge (a 500-ton bridge at $1/lb), the 3% savings will be $30,000.

- *Developing a One-Coat Paint System*

The cost of protecting steel could be nearly halved (from approximately 11 to 12% to approximately 6%) by developing and using a one-coat system. The savings on the hypothetical 500-ton bridge purchased for $1/lb will be an additional $30,000. As yet, no suitable one-coat material has been successfully identified, tested, or approved. A pending FHWA research study is awaiting funding (see http://www.pooledfund.org/documents/solicitations/924.pdf).

- *Training and Prequalifying Contractors and Painters*

The issues that limit service life are, in part, training-related and partly influenced by how bridge painting contracts are awarded—which is generally to the lowest bidder, not necessarily the lowest responsible bidder.

SSPC operates effective training and certification programs for painting contractors and painters. Improvement in performance in this area comes when owners demand an end to unacceptable workmanship. In some cases, training requirements for contractors and painters may need to be tightened. Available from SSPC, coatings suppliers, consultants, unions, and others, training for painters should be fully utilized. Contractor prequalification programs like those of SSPC should be specified.

Where needed, painting contractor prequalification requirements should be re-examined, updated, and utilized to be sure that the job is really awarded to the lowest *responsible* bidder.

The Forth Rail Bridge in Scotland, a steel cantilever bridge completed in 1890. Courtesy of Peter Morgan

- *Replacing Deicing Materials Containing Chlorides*

DOTs have used road salt (sodium chloride) heavily for 50 years as a deicer, but the ultimate price of salt-induced corrosion is very high. Alternative deicing materials should be re-examined to see whether a material that is less corrosive to steel but still effective as a deicer can be identified.

- *Removing Chlorides From Contaminated Steel Surfaces*

A means is needed to remove chloride contamination from bridge steel before repainting. Chloride contamination is believed to be the single biggest reason coatings fail on bridge repainting projects.

In spite of past research, an economical, practical means of chloride removal/remediation on existing steel is not yet available. Several methods, including both dry and wet abrasive blast cleaning methods as well as water jetting, have been noted as possible methods of chloride remediation.

Unfortunately, a method to measure the amount of chlorides remaining within the pits on pitted steel surfaces after cleaning has not yet been developed either.

The issue of chloride removal/remediation on steel surfaces before repainting should be more thoroughly researched.

- *Recognizing the Importance of Maintenance Painting*

Bridge painting must be seen by Federal, state, and local government agencies as a legitimate, crucially important, ongoing maintenance activity that is funded adequately every year.

- *Total Mill Scale Removal*

There is doubt in the author's mind whether the removal of all mill scale is necessary. It is acknowledged that in the steel/mill scale galvanic couple, steel becomes the anode and therefore will corrode in the presence of moisture. However, there is a great deal of practical evidence to suggest that its complete removal may be overkill. In mild service environments, the presence of mill scale in conjunction with a fast-curing, two-coat (or one-coat) paint system could prove to be effective for decades. The use of such an approach could reduce the cost of corrosion protection on those structures by as much as 75 percent. Note that in Europe, the blast cleaning standard for Commercial Blast Cleaning allows some mill scale to remain. In the United States, an old Maryland State Highway Administration pictorial standard for Commercial Blast Cleaning also allowed flecks of mill scale to remain. Blast cleaning standards SSPC-SP 5, White Metal Blast Cleaning; SSPC-SP 10, Near-White Metal Blast Cleaning; and SSPC-SP 6, Commercial Blast Cleaning require the complete removal of all mill scale. Some mill scale is permitted to remain on surfaces blast cleaned in accordance with SSPC- SP 14, Industrial Blast Cleaning.

In short, the need to completely remove mill scale should be re-examined. Coatings that can keep water from the mill scale/paint interface may prove that the old practice of painting over mill scale can still be effective in the modern age of steel bridges. Research should be undertaken regarding the need to remove mill scale and to what extent.

Closing Thoughts

Mill scale takes us full circle. The lead and chromate systems could adhere to steel with mill scale. For the zinc-rich systems that succeeded lead systems, mill scale had to be removed. Finding replacement coatings that can tolerate mill scale or determining that mill scale does not always require complete removal will be a significant step toward lowering the cost of bridge painting while maintaining coating service life of many decades, even 100 years.

Eric Kline, executive vice president/senior consultant for KTA, has over 35 years of experience in the protective coatings industry and is an active member of SSPC.

BIBLIOGRAPHY

"A Highway Accident Report – Collapse of U.S. 35 Highway Bridge," National Transportation Safety Board, 1971.

"A Highway Accident Report—Collapse of a Suspended Span of Rte. 95 Highway Bridge Over the Mianus River, Greenwich, CT, June 28, 1983," National Transportation Safety Board, July 19, 1984.

Albrecht, P. and Hall, T. T., "Atmospheric Corrosion Resistance of Structural Steels," *Materials in Civil Engineering*, Volume 15, Issue 1, Jan/Feb 2003.

Albrecht, P. and Naeemi, A., "Performance of Weathering Steel in Bridges," Transportation Research Board, National Cooperative Highway Research Program, Report 272, July 1984.

American Iron & Steel Institute Corrosion Advisory Group case studies.

Appleman, B. A., "Improving Bridge Painting Specifications," *JPCL, Sept. 1988.*

Appleman, B. A., "Lead-Based Paint Removal for Steel Highway Bridges," National Cooperative Highway Research Program Synthesis 251, 1997.

Appleman, B. A. and Kline, E. S., "Analysis of Costs for Shop Painting of Bridges," September 2003, FHWA-RD-05-xxxx, unpublished.

Article: "Iron Corrosion, Corrosion Resistance," Cast Iron Soil Pipe Institute, (http.www.cispi.org/corrosion_resistance.html)

Brown, David J., "*Bridges: Three Thousand Years of Defying Nature*," Firefly Books US, Inc., Buffalo, NY, 2005.

"CALTRANS Completes Study of Coatings for Cathodic Protection of Concrete in Bridges," News from the Field, *JPCL*, February 1990.

Carter, Paul, "Developing a Performance-Based Specification for Concrete Sealers on Bridges," *JPCL*, January 1993.

"Chapter 23: Corrosion Protection of Steel Bridges," *Steel Bridge Design Handboo*k, National Steel Bridge Alliance. "Characterization of the Environment," Federal Highway Administration Research Project, FHWA-RD-00-030, August 2000.

Chong, Shuang-Ling, "A Comparison of Accelerated Tests for Steel Bridge Coatings in Marine Environments," *JPCL*, March 1997.

"*Corrosion Engineering*," Mars Fontana, 1986, p. 292.

"Corrosion of Metals and Alloys – Corrosivity of Atmospheres – Guiding Values for Corrosivity Categories," International Standards Organization Standard 9224, 1992.

"Corrosiveness of Various Atmospheric Test Sites as Measured by Specimens of Steel and Zinc," *Metal Corrosion in the Atmosphere*, ASTM STP 435, American Society for Testing and Materials, 1968.

Delony, Eric, "The Golden Age of the Iron Bridge," *Invention & Technology Magazine*, 1994, (http.www.americanheritage.com/articles/magazine/it/1994_2_8.shtml)

Dexter, R., "Performance Testing of Modular Bridge Joint Systems," National Cooperative Highway Research Program Report 467, 2002.

Dupre, Judith, "*Bridges: A History of the World's Most Famous and Important Spans*," Black Dog and Leventhal Publishers, New York, 1997.

Ellor, J., Young, W., and Repp, J., "Thermal Sprayed Metal Coatings to Protect Sheet Piling: Final Report and Guide," National Cooperative Highway Research Program Report 528, 2004.

"Environmentally Acceptable Materials for the Corrosion Protection of Steel Bridges," Federal Highway Administration Report FHWA-RD-96-058, Jan. 1976.

Farschon, C. L. and Kogler, R., "Field Testing Maintenance Overcoating Systems for Bridges," *JPCL*, January 1997.

Federal Highway Administration Technical Advisory, "Uncoated Weathering Steel in Structures," T5140.22, 1989.

FHWA Bridge Coatings Technical Note – Metallizing, 1998.

Graf, Bernhard, "*Bridges that Changed the World*," Prestel, New York.

"Issues Impacting Bridge Painting: An Overview," Federal Highway Administration Research Report FHWA-RD-94-098, August 1995. Joint Surface Preparation Standard SSPC-SP 12/NACE No. 5 Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating, July, 2002

Kogler, R., "Coating Material Selection for Optimum Steel Bridge Life Cycle Cost," 16Th Annual US/Japan Bridge Engineering Workshop, October 2002.

Kogler, R., "Steel Bridge Lifecycle Corrosion Control Options," Transportation Research Board Annual Meeting, 2002. Lecture 1B.4.1: "Historical Development of Iron and Steel in Structures" (www.kuleuven.be/bwk/materials/teaching/master/wgo1b/10410.html)

Leyland, D. S., "Coatings Systems Used by State Highway Departments," *JPCL*, May 1985.

Lohrey, E. C., PE, "Metallizing Steel Bridges in the Field," *JPCL*, May 1995.

McDad, B., Laffrey D., Damman, M., and Medlock, R., "Performance of Weathering Steel in TxDOT Bridges," Texas Department of Transportation, May 2000.

"Oregon DOT Uses Zinc Metallizing with Cathodic Protection on Concrete Bridges," *JPCL*, August 1992.

"Painting Steel Bridges and Structures," *Good Painting Practice*, Volume 1, Chapter 6.1; SSPC: The Society for Protective Coatings, 2002.

"Performance of Weathering Steel in Highway Bridges – A First Phase Report," American Iron and Steel Institute, August 1982.

"Performance of Weathering Steel in Highway Bridges – A Third Phase Report," American Iron and Steel Institute, 1995.

"Project Work Plan for the Evaluation of Structural Steel Coatings," American Association of State Highway and Transportation Officials, National Transportation Product Evaluation Program, www.ntpep,org, June 2004.

"Specification for Structural Joints Using ASTM A325 or A490 Bolts, Appendix A, Class B," Research Council on Structural Connections, June 23, 2003.

"Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel," SSPC-CS 23.00/AWS C 2.23M/NACE No. 12, July 2003.

"Standard Specifications for Highway Steel Bridge Coating Systems with Inorganic Zinc-rich Primer," American Association of State Highway and Transportation Officials/National Steel Bridge Alliance Steel Bridge Collaboration, 2003.

Technical Information Packet Service, Tip 15, *Bridges: Cleaning and Painting*, 3rd edition, TPC Books, Pittsburgh, PA.

Trimber, K. A. and Neal, T. W., "New Procedure for Field Classification of Paint Condition," *JPCL*, November 1987.

Volume 1 *Good Painting Practice* and Volume 2 *Systems and Specifications*, *Steel Structures Painting Manual*, SSPC: The Society for Protective Coatings.

Whitney, Charles, "*Bridges of the World, Their Design and Construction*," Dover Publications, Mineola, New York, 2003

Winick, R. M. and Sampson, P. E., "Multi-Functional Calcium Sulfonate/Alkyd Coatings: An Alternative to Epoxy Mastics for Bridge Maintenance," Technical Information Packet Service (TIP) 15 – *Bridges: Cleaning and Painting*, 3rd Edition, TPC Books, Pittsburgh, PA.

Fluoropolymer Topcoats Show Promise for Durability

Condensed from "Fluoropolymer Topcoats for Bridges," by Winn Darden, AGC Chemicals Americas

While the development and widespread use of polyurethanes and polysiloxanes have increased the longevity of topcoats, there still exist considerable differences in the long-term durability of zinc-rich primers and topcoats.

Fluoropolymers, developed in the 1960s, have always offered intriguing possibilities for coatings. Their desirable properties include extreme weatherability and chemical resistance, low surface energy for anti-graffiti properties, and corrosion resistance. The use of fluoropolymer resins for topcoats would allow for the retention of desirable topcoat properties (corrosion protection, original color and gloss) for as long or longer than those achieved by zinc-rich primers. Unfortunately, the application characteristics of fluoropolymers have limited their use in field-applied coatings. Most fluoropolymers form films only at high temperatures, either by melting or coalescing from solvents. Adhesion of fluoropolymers to metal is poor, but can be improved by the addition of other resins, which can compromise other physical properties. In addition, many fluoropolymers are difficult to recoat due to their low surface energy.

The Akashi Straits Bridge in Japan
Courtesy of Winn Darden

To address these shortcomings, researchers in Japan developed a group of products known generically as FEVE (fluoroethylene vinyl ether) resins in the early 1980s. Coatings made from them offer the weatherability of fluoropolymers combined with properties found in conventional coatings like polyurethanes. Coating properties can be modified by slight changes in the structure of the FEVE resin, which are soluble in solvents, and can be made water-compatible, making them familiar and easy to use in the field. The chemistry used in formulating FEVE-based coatings is exactly the same as that of conventional polyurethanes, and application equipment is exactly the same as well. Thus, FEVE coatings can be applied in the shop for new construction, or in the field for bridge rehabilitation.

Although initially somewhat more expensive than urethanes or siloxanes, fluoropolymers offer considerable reductions in coating life cycle costs, in bridge downtime, and in traffic problems during repainting.

Coatings made with FEVE resins also offer excellent corrosion resistance. Zinc-rich primers are the main defense against corrosion on steel bridges. Conventional topcoats gradually lose thickness and erode over time due to degradation by UV light, rain, wind, and chemicals. When the conventional topcoat erodes completely, the midcoat begins to degrade, increasing the probability of corrosion. Fluorourethanes do not lose significant thickness over time, and therefore continue to impede the movement of corrosion initiators through the topcoat.

Recently, bridge designers have begun to explore the use of more varied colors in bridge topcoats, moving away from standard lighter colors like yellow and grey. Fluorourethane topcoats offer the possibility of using unconventional colors for bridges, while ensuring the designer that the original gloss and appearance will remain intact for many years.

Most of the long-term research on FEVE-based coatings has been done in Japan. In the 1980s, a series of bridges were recoated, usually half with a FEVE-based topcoat, and the other half with a topcoat commonly in use at the time. The condition of these bridges was monitored over time, and as a result, FEVE topcoats have now been used on dozens of bridges in Japan. Probably the best known is the Akashi Straits Bridge, which is the world's longest suspension bridge. The bridge is over 12,000 feet in length, with the single longest span of over 6,000 feet. The bridge was opened in 1994. Coatings were primarily shop applied and finished in the field. Multiple FEVE topcoats are meant to give a coating life in excess of 60 years.

Based on extensive testing over the past 25 years, the Japanese Ministry of Land, Transport, and Infrastructure issued its new national specifications for coatings for steel bridges in August 2006. "Japanese Specifications for Steel Bridge Coatings" requires fluoropolymer topcoats on all bridges in Japan, for both new construction and rehabilitation. Bridges topcoated with fluoropolymer resins are expected to have useful lives, exceeding 50 years in some cases, to significantly reduce costs associated with recoating bridges in the field, and to postpone the need for recoating of new bridges.

FEVE fluorourethanes are beginning to find application in the U.S. as well. A series of bridges in Nashville, TN, have been fully or partially topcoated with fluorourethanes: the Shelby Street Bridge, Gateway Bridge, the Woodland Street Bridge, and the Victory Memorial Bridge.

Concrete Bridge Durability: Extending the Performance Envelope with Coatings

Part 5

States Continue to Pursue the Value of Protective Coatings for Concrete Bridge Structures

By Bob Kogler, Series Editor, Rampart, LLC,

This article is the fifth in a series addressing the use of coatings to enhance concrete bridge durability. The issue of long-term durability of the nation's bridges has received increasing attention over the past year. Although concrete structures were once thought to be inherently durable beyond large-scale concern, the collective opinion of bridge owners is changing in that regard. As the maintenance burden for existing bridges increases and the benchmarks for lifetime performance become increasingly demanding, the need for materials and methods that enhance and extend service life grows. Coatings provide a largely untapped source of service life extension for concrete bridge structures.

This article expands on the continuing efforts of three state transportation departments that were highlighted in the second article in this series, published in the July 2007 *JPCL*. The states—Wisconsin, Kentucky, and California—all presented their recent findings at the PACE 2008 conference in January. The following provides an abridged version of each state's presentation. Full text copies can be found in the proceedings from PACE 2008 (www.sspc.org).

The efforts of these three states outline the scope of the overall issue and extent of the efforts required to effect positive change in the durability of concrete bridges using coatings. These three accounts address three major aspects of the overall effort. Wisconsin's work follows a fast-track, "find it and fix it" approach. Bridge personnel recognized a pervasive problem with the deterioration of beam ends and conducted applied research and testing to demonstrate the viability of coatings in providing enhanced durability. Also, to their credit, they quickly moved to change their requirements to mandate more durable practices.

Kentucky's work addresses another critical aspect of the question – how can an owner choose the proper coating material in a rational manner? There are many standardized tests available to evaluate coatings. Some address coatings applied to concrete, but few specifically address the stresses and requirements of coatings applied to bridge structures in the highway environment. Leveraging the success and experience of the AASHTO-NTPEP coating qualification program for steel bridge coatings (see "Qualification of Coating Systems through Performance Evaluations," by Greta Smith, September 2004 *JPCL*), Kentucky has taken the first difficult steps toward defining a similar common, national approach for concrete bridge coatings qualification testing.

CALTRANS came heavy to the party. Bridge personnel had a critical need for extended service life on a new major structure. They showed the courage to trust a technology that promised long-term value, but one that was somewhat new to the bridge market. In taking this bold step, they have provided an extremely valuable datapoint to the rest of the industry and have shown that although there were key lessons learned during the San Mateo Bridge coating project, the overall efficacy of coatings for providing extended performance life for bridges is promising.

Following each report below are observations from this editor.

Find It and Fix It

Condensed below are findings reported in "Application of Protective Coatings For Rehabilitation of Wisconsin Concrete Bridges" by Al Ghorbanpoor, University of Wisconsin; Edward A. Fitzgerald, Wisconsin Department of Transportation; and Habib Tabatabai, University of Wisconsin.

Like many other highway departments in the U.S., Wisconsin has experienced major corrosion problems in reinforced and prestressed concrete bridges over the last few decades. Bridge owners and bridge inspectors/program managers in these states have also found that many of the existing corrosion protection methods as well as repair and rehabilitation techniques are not effective for long-term performance. In many cases, repaired areas have shown signs of repeated failure within a two-year period.

Responding to the need for identifying effective materials and techniques to offer protection against corrosion of steel

Corrosion at concrete beam end with salt infiltration
Photos courtesy of the authors

in concrete as well as patch repair in concrete girders, Wisconsin DOT recently conducted a concrete coating test through the University of Wisconsin-Milwaukee. The study was sponsored by the Wisconsin Highway Research Program (WHRP) of the Wisconsin Department of Transportation.

All surfaces near the ends of five new prestressed concrete I-girders were treated with various coating materials, and the girders were subjected to cyclic exposures of a sodium chloride solution and a galvanostatic accelerated corrosion test for a period of 18 months. The coating or treatment materials used in the study included a polymer resin coating, an epoxy coating, a solvent-based silane penetrating sealer, a microsilica/latex-modified patch material, a waterborne epoxy and cementitious patch material, and a fiber-reinforced polymer material.

The experimental program determined the effectiveness of the materials and techniques used for protection against corrosion. Through new specification requirements, the Wisconsin Department of Transportation will implement the results of this study in the construction of new prestressed concrete bridges to achieve better protection against corrosion of prestressing steel at the ends of prestressed I-girders.

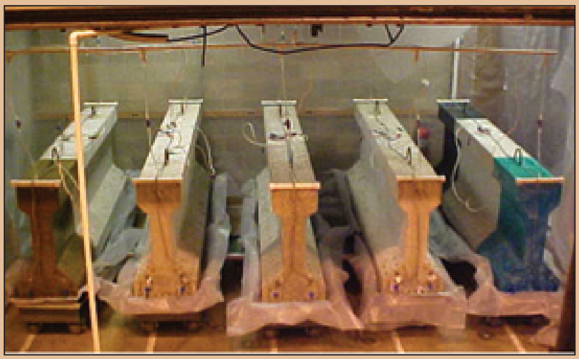
Experimental Program

Beam ends were treated with the candidate materials. One beam end was excluded from the coating application for the purpose of comparison between the treated and untreated concrete surfaces. Following the coating treatment, all girders were subjected to cyclic exposures of a sodium chloride solution and a galvanostatic accelerated corrosion test for a period of 18 months. During various phases of the experimental program, corrosion current was monitored through conducting half-cell potential tests. Also, at each beam end, chloride contents of concrete at various depths were measured based on the Rapid Chloride Test

Interior and exterior views of corroded, contaminated girders

(RCT) 1029 method. Visual indications of corrosion, such as rusting and cracks, were recorded during the experimental study. At the conclusion of the experimental work, all relevant prestressing steel in the girders was exposed for visual examination to determine the extent

Degradation at beam ends



Experimental set-up with treated and untreated beams

of corrosion. A numerical rating based on the extent of the presence of chloride content, cracking, and corrosion was developed and used to indicate the level of performance for each protective coating material and technique used in the study.

It was found that while some of the coating materials in the test program were ineffective, there were also coating materials that proved to be effective in offering significant protection against corrosion under aggressive conditions. The best corrosion protection was achieved when the ends of the I-girder specimens included polymer resin coating (with and without carbon fiber-reinforced material) or epoxy coating.

Follow-Up Studies

The results of this project have spurred two other studies to further evaluate concrete repair and rehabilitation materials and sealers in the area of rebar protection, spall prevention, and repair techniques for concrete girders and bridge decks. The new studies will evaluate materials and methods identified as promising in the first project to determine their effectiveness. These studies will include a series of laboratory tests as well as assessment of the effectiveness of selected sealers that have been applied to bridge decks over the past ten years. Chloride contents at various locations and depths will be measured and analyzed to determine the effectiveness of the protective coating applied over certain service times.

Conclusion

The study has identified effective and practical coating and patching materials to provide corrosion protection of steel reinforcement in concrete bridge members that are subjected to aggressive environmental conditions. These results are being incorporated in the Wisconsin Department of Transportation's Materials Specifications and Wisconsin Construction Specifications Manual, effective sometime in 2008. The specification will require contractors to apply the recommended protective coatings to the ends of prestressed concrete I-girders before they are transported to bridge sites for new construction.

OBSERVATIONS ON THE WISCONSIN STUDY

It is important to note from the Wisconsin study that some of the treatments performed well, while others performed poorly. This indicates that coatings provide a viable protection option for concrete beam ends; however, it also points to the importance of proper material selection. It is very important to hesitate to draw broad conclusions about "coatings" generically because many poorly selected applications will result in poor performance. This has been the case over past decades with many low-cost, low-technology waterproofing and thin-film sealer materials; based on a few failures of these materials, owners have often developed negative biases. As the use of coating technology for concrete bridge protection expands, the focus on coating performance will become increasingly important. As a community, we must become more rational and sophisticated in our material selection efforts—a point that is paramount in the Kentucky Transportation Cabinet work described next.

How Do You Choose a Coating?

The report below is an abridged version of "Concrete Bridge Coatings in Kentucky: Progress in Lab and Field Testing Results," by Dee McNeill, Sherwin-Williams Company; and Derrick Castle, Kentucky Transportation Cabinet.

Inventory reviews of structures on NHS routes show a 34% increase in the number of prestressed concrete structures rated as structurally deficient between 1992 and 2005, while the percentage of steel structures rated as structurally deficient decreased by 40%. (See references.) In addition to the use of concrete in designs of bridge superstructures, general observation indicates the majority of all bridge designs use concrete substructures—piers, bents, and abutments as support structures.

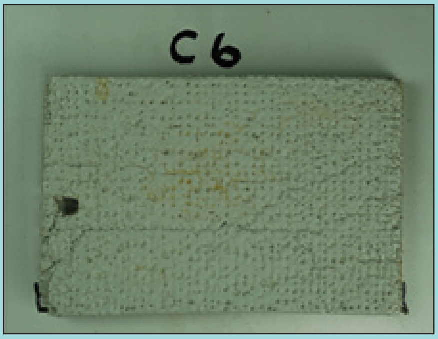
Recent failures of concrete superstructure members coupled with the prevalence of concrete substructure components exhibiting excessive deterioration are compelling evidence that concrete structures are in need of attention. Coating manufacturers spend millions of dollars a year on research and testing of coating systems for steel structures. In contrast, concrete coating systems get a small portion of this expenditure. This is due to the fact that the typical systems being utilized for concrete coatings (for bridges) make use of old technologies that were developed with a primary focus on aesthetics.

The Kentucky Transportation Cabinet and the University of Kentucky's Transportation Research Center partnered with manufacturers in the coatings industry to evaluate thin-film coating systems for concrete bridge structures. The following generic classifications of systems were evaluated under this project: epoxy/urethane, waterborne epoxy/acrylic, acrylic/acrylic, waterborne texture coating, solvent-borne stain, and waterborne stain. Selected systems were evaluated in both laboratory accelerated testing and field testing. The following test methods were employed with a goal of testing the coating systems as well as evaluating the viability of the test method itself:

- ASTM D 5894, Cyclic Salt Fog/UV Exposure of Painted Metal;
- ASTM D 4541, Pull-Off Strength of Coatings Using Portable Adhesion Testers;
- AASHTO T259, Resistance of Concrete to Chloride Ion Penetration; and
- ASTM E96, Water Vapor Transmission of Materials.

Lab and Field Test Set-Ups

For accelerated testing, several commercially available fiber-reinforced cement boards were tested as substrates. The cement board that demonstrated the best overall durability was selected as the substrate for accelerated testing. The board had a one-half inch nominal thickness and was cut into four- by six- inch panels. The panels were sweep-blasted (SSPC SP 7/NACE 4) using coal slag abrasive just above the reinforced web to give a profile to the surface. Also, four-inch by eight-inch cylinders of class AA concrete were prepared, cured, and saw cut into halves vertically and blasted to provide flat surfaces for adhesion testing. Class AA concrete was also used to prepare concrete specimens for chloride ion penetration testing in accordance with AASHTO T259, Resistance of Concrete to Chloride Ion Penetration.



Coated panel for accelerated testing

Field applications and evaluations of the concrete coating systems were performed on 20-year old segments of the west bound barrier wall of a bridge crossing the Kentucky River on the US 676/US 421 East-West Connector in Frankfort, KY. Coatings were applied over two surface preparations: low-pressure water washing (0° spinner tip, 3,000 psi) and sweep-blasting using coal slag abrasive. A twelve-inch vertical section at the joint between the alternating prepared surfaces received an application of typical concrete patch material used by the KYTC. This section was used to evaluate the performance of the applied coating systems over patching material in addition to prepared concrete surfaces. Each test area was also sampled for pre- and post-test chloride level (AASTHO T260, Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials).

Portion of barrier coated for atmospheric testing
Photos courtesy of the authors

Test Procedures

Laboratory test samples were cured for 30 days under laboratory conditions, photographed, and checked for initial color prior to accelerated testing. For water vapor transmission testing, free films were made using drawdowns on release paper, cured for seven days, and cut into three-inch diameter circles for testing.

Panels and cylinders were subjected to 5,000 hours of accelerated weathering in accordance with ASTM D 5894. Due to the nonmetallic substrate, performance evaluation focused on the adhesion and color retention properties of the coating systems. Adhesion of the coating systems to the panels was evaluated visually, with the panels assessed for blistering or delamination from the substrate. Color retention was evaluated using a color spectrophotometer. The finish coat of the all systems was an off-white color; therefore, the color evaluation was limited to determining each coating's ability to resist yellowing. Based on the classifications evaluated, only systems utilizing acrylic finish coats demonstrated color shifts in excess of 6 Delta E* as calculated using the CIE 1976 L*, a* and b* coordinates, D 65 illuminant, and 0/45 geometry.

Adhesion measurements (ASTM D 4541) were taken before and after exposure of the coated cylinders in accordance with ASTM D 5894. Adhesion values for the coating systems were in excess of 500 psi and exhibited minimal reductions after exposure testing. The ability of each coating system to resist chloride ion penetration was evaluated in accordance with AASTHO T259 and AASHTO T260. Uncoated control specimens were also tested. These control specimens were sampled and tested to establish baseline chloride content from the concrete used to prepare the specimens, 2.7 ppm chloride, as well as to determine the concrete's ability to resist chloride ion penetration: 27 ppm chloride at 13 mm depth and 3.4 ppm chloride at 25 mm depth. Under this evaluation, the coating systems representing epoxy/urethane and solvent-borne stain showed the greatest resistance to chloride ion penetration, allowing no statistically significant increase in chloride ion concentration.

In addition to AASHTO T259 and AASHTO T260, ASTM E 96 was used to evaluate water vapor transmission rates of submitted coating systems. The logic was to compare water vapor transmission rates to the ability of the same system to resist chloride ion penetration. Attempts to correlate values from these procedures show that vapor transmission rates of greater than 200 grams per square meter per 24 hours provide little chloride ion penetration resistance. Of the systems tested, the epoxy/urethane system demonstrated the lowest vapor transmission rate: 16 grams per square meter per 24 hours.

Pitfalls were discovered in preparing specimens for this testing. Commercially available release papers were utilized to prepare free films of the coatings systems for evaluation. However, technicians were unable to prepare a free film of the solvent-borne stain because it adhered to each release paper tested. The effect of the release agent from the release paper that may or may not have been absorbed into the applied coating was not investigated.

Conclusion

Field observations were conducted for twelve months. During the evaluation period, only the waterborne epoxy/acrylic and epoxy/urethane systems demonstrated satisfactory durability to exterior exposure. The solvent-borne and acrylic stains, acrylic/acrylic, and acrylic texture coatings demonstrated excessive weathering, resulting in exposure of the substrate.

Based on this initial battery of tests and for this initial sample of coating materials, it appears that coating systems that make use of a cross-linked coating creating a dense film such as an epoxy or urethane yielded the best overall performance.

The Cabinet and the Transportation Research Center wish to take the lessons learned from this study and evaluate both a broader cross-section of coatings technologies and testing methodologies. This broader approach is expected to assist the Cabinet in determining what test methods will provide discriminating data to be utilized in the development of a performance-based specification for concrete coatings.

References

1. "Concrete Bridges: Heading Off The Impending Durability Burden" *JPCL* April 2007

2. Bridge Management Information System, (BMIS); Federal Highway Administration

Observations on the Kentucky Work

The Kentucky work provides a key first step in the process to evaluate and document the usefulness of testing (both laboratory and field) to choose the most appropriate materials. It has taken the transportation community many years of dedication and coordination among agencies to come to the current point of shared test data for qualifying coatings for steel bridges. The hope is to accelerate a similar process for concrete coatings by leveraging the experience, relationships, and process developed during the steel coating work. Also, not to be discounted are the cooperation and the technical and financial support of coatings manufacturers that make the AASHTO-NTPEP program a success. This program serves as a valuable cooperative model for our community to truly realize the value of coatings for concrete bridges in the near future.

Specifically encouraging in the Kentucky results is that the initial screening of unsuitable coatings was possible within a short period of time (1 year), even in non-accelerated field exposure.

A Bold Step in California

Abstracted below is "Inspection of the Polyurea on the San Mateo Bridge," by Dirk Summers, Lisa Dobeck, Todd Smith, Gary Lai, and Addis Ambaye, Caltrans.

Summary of Findings

The San Mateo Bridge represents the largest application of thick-film coatings for protection of a concrete highway bridge in the U.S. to date. This challenging project was undertaken to provide an aggressive extension to the expected service life of the new concrete components of the widened bridge. This report provides a brief summary of the coating application process during construction followed by a report of a recent visual inspection performed at the five-year point in service. Much of the following details the key problems and issues associated with performing a coating project of this scale under the demanding conditions and pressure of a construction schedule. Overall, the project is considered to be a success by Caltrans at this point because the number and extent of failures are thought to be manageable and explainable based on specific issues discovered during initial application.

Background, 1999 to 2002: The Construction Years

The San Mateo Bridge consists of a five-mile trestle and a high-rise structure. A second trestle structure was designed to be built next to the existing one. During the design process for the second structure, there were size and weight constraints for certain precast elements that limited the thickness of the concrete cover. Caltrans wanted a 125-year life for this structure; and to obtain this, the consultant designers specified a 60-mil polyurea coating system. Application was to take place in the precast yard. The polyurea was to be applied to the top portion of the piles, the exposed surfaces of girders, the underside and sides of the pile cap and cast-in place overhang, and the underside of the deck plates. The girders span 85 feet, with 8 girders per span and 3 piles per pile cap. The trestle portion is 4.7 miles in length, so it can quickly be seen that there were a couple years of production and coating at the precast yard. The coating alone cost 10 million dollars, and the project was the largest polyurea application in the U.S. at the time.

There wasn't a building large enough at the contractor's yard to house the precast pieces for coating. The coating contractor had little choice than to coat what he could in the open. Because the job proceeded year round, with the prime contractor demanding coated product to be delivered in the shortest time possible, weather quickly became an issue. Tents and rolling covers were employed, with rudimentary environmental controls in place. In addition to the polyurea, an epoxy primer was required to be applied to the freshly blasted and cured concrete. The polyurea had to be light-stable, or have a light-stable coating applied to the surface. Due to the cost of aliphatic, light-stable polyurea the contractor elected to use a polyaspartic finish coat over aromatic polyurea. Aromatic polyurea is less expensive, and it will significantly change color when exposed to sunlight.

The contract required a finished product free of visible pinholes and holidays. When the polyurea was applied, it was pumped through lines heated to 160 F and mixed together at the nozzle of the spray gun. The coating would set to full cure within 2 seconds after being mixed together. When the hot polyurea hit the surface, the heat would expand the air in a partially sealed rock pocket (bughole), creating a pinhole extending to the substrate. Abrasive blasting the surface of the precast element would open some of the rock pockets found in the cast concrete. If the rock pocket had a small opening not opened by abrasive blasting, the pocket was likely to create a pinhole in the polyurea. At the beginning of the contract, the contractor tried many approaches to preventing pinholes: casting sand in the wet primer, parging the entire surface with thickened primer, and filling pinholes with polyaspartic finish coat by hand afterwards.

Fig. 1: Pile cap/pile interface, with polyurea delaminated from the joint. Photos courtesy of the authors

Fig. 2: North facing girder

Fig. 3: Edge of the deck and barrier rail on top of a girder

As with any project where the coating is only a portion of ongoing construction, delays as a result of coating processes caused big problems for the prime contractor. As the prime contractor got behind, its management requested the concrete precast pieces be allowed to cure 15 days instead of 28 days prior to coating. This was approved as long as the surface moisture present did not exceed the surface dryness requirement in NACE RP-0892. The frenzied pace was also not conducive to troubleshooting the coating. The epoxy primer was difficult to inspect because its color was similar to that of the concrete and the primer was applied at a very thin film thickness.

An ongoing problem was the epoxy primer being mixed off ratio due to equipment issues. This led to quite a few intercoat adhesion failures of the polyurea system and polyurea applied directly over concrete in some areas. This resulted in large sheets of disbonded polyurea in selected areas.

Disbonding would occur at the precast yard, after shipment to the jobsite, or after the bridge was put together and installed. The strength of the bond and how the piece was handled determined when the coating failed. When properly applied, polyurea is very difficult to remove. One manufacturer claimed it could only be burned off the surface with a blowtorch if it had to be removed and redone.

During the construction phase, Caltrans laboratory personnel were asked to come out to inspect some blisters in the coating system. The quarter-sized blisters contained fluid. Upon analysis, the substrate under the blisters was found to be coated with only the A component of the epoxy primer. The A component was extremely hygroscopic, absorbing more than 80% of its weight in moisture from the air when left to sit

Fig. 4: Pile cap looking from the north. Notice the yellowed polyurea.

out overnight in the lab. The A component preferentially attracts moisture from the concrete, collecting enough to create a bubble visible in the polyurea. In this case, the mixing at the spray nozzle would likely "sputter," or allow one component to come out without the other. So a blister would occur right next to tightly adhering polyurea. Caltrans inspectors used a hammer to find hollow spots in the polyurea, listening for delaminated spots that hadn't blistered or peeled back yet.

The minimum adhesion specification requirement for the polyurea system was 290 psi. The contractor was able to exceed this value with little effort when the materials were properly applied. But the multishift schedule and the magnitude of the project combined to make inspection monotonous and challenging. It should be noted that the inspection at the jobsite and the subsequent repairs were generally effective: 5 years later the coating looks very good.

On the San Mateo project, there were two different coating contractors. The one with more plural-component coating experience demonstrated fewer problems during the work. Around 2001, the Richmond San Rafael Bridge had polyurea applied to the piers at the waterline, behind the ship bumpers. The polyurea system specified was the same as the one on the San Mateo Bridge. The amount of polyurea used on the San Rafael bridge was about one tenth of what was used on San Mateo. For the San Rafael, the shop and field coating contractors were both experienced with polyurea. Both the work in the precast yard and in the field went without a problem. To this day the material looks as good as the day it went on.

October 2007 Inspection

Five years after the bridge was opened, the coating is looking pretty good. Not every bent (528 in all) was inspected in detail, but more than 4 miles of the bridge were visually inspected. Most of the coating defects observed were sheets of delaminated polyurea on the pile caps. The inspectors reported that all the precast elements were equally subject to delaminating polyurea during construction. No significant delamination of coatings from the deck plates or girders was observed. There was minimal polyurea delamination on a few of the piles.

Fig. 5: Delaminated polyurea on corner of pile cap

Of all the possible damage to the pile cap, the most common was the delamination of the polyurea at the pile/pile cap interface.

The area shown in Fig. 1 has about 2-3 inches of fresh concrete around the perimeter of the pile as it goes through the pile cap. The field applicator would chip the new concrete flush with the pile cap and abrade the existing polyurea for about 6 inches around the fresh concrete with a mechanical sander. The entire area was primed and then a slow-set—a hand-mixed version of polyurea— was applied. The slow-set polyurea could be applied to small areas without mobilizing a spray rig. This process was hampered by difficult coating conditions. Access, moisture, and ambient temperature each played a role in the field conditions. Often, existing off-ratio primer would cause a problem. The corner and large sheets disbonded, taking the polyurea patch with it.

Most field coating took place on the area of the pile cap between the girders and on either end of the pile caps. The contractor used standard spray application equipment, with mixing at the nozzle. Instead of a polyaspartic finish coat, a final coat of 50% solids aliphatic polyurea was applied to blend in with the existing polyurea and protect the aromatic polyurea from light. In only one place, the coating delaminated between the girders. Other than this one location, no other defects from the spray application performed by the more experienced field-coating contractor were found. [Editor's note: This result shows that with knowledge and care this highly durable system can be applied in the field under demanding conditions.]

In Fig. 2, patches can be seen on girders, where blisters were cut out and polyurea re-applied. The yellowed coating is untopcoated aromatic polyurea. The color change in these isolated areas justifies the specification of the light sta-

Fig. 6: Polyurea peeling away, no indication the primer was present

Fig. 7: Polyurea delaminated with no primer evident on the pile cap.

ble topcoat. Caltrans wanted a concrete gray material. The yellowing is purely aesthetic and is not expected to affect performance.

Figure 3 is an example of peeling topcoat on the edge of the deck plate. The polyaspartic topcoat is very thin. Any peeling is purely aesthetic and not a cause for concern. As long as there is polyurea under the peeling topcoat, the barrier is intact.

Of greater importance to the life of the structure is when the polyurea completely delaminates from the substrate (Figs. 4 and 5).

When the epoxy primer is off-ratio, the polyurea lacks adhesion. The more off-ratio it is, the worse the adhesion. When the polyurea peels off, dark stained concrete indicates the epoxy primer was applied. In Figs. 6 and 7, the concrete is lightly colored and there is no evidence of epoxy primer having been applied to the pile cap or girder.

About 40 pile caps were observed with polyurea peeled from the substrate. There are an estimated 528 pile caps on the bridge, equating to a failure rate of about 8%.

Only a couple of piles had delaminated polyurea. This was a case where the off-ratio primer had enough adhesion to survive the pile driving only to come off after the job was completed. With 3 inches of concrete cover, any missing polyurea is not important (Fig. 8).

Fig. 8: Bent 694, polyurea delaminating from the pile

Observations on the Caltrans Work

The five-year inspection of the San Mateo Bridge proved positive overall. This was a massive and challenging coating project. It was done with new technology and an "on the fly" learning curve for the owner and contractors. It also had an aggressive schedule. Given these parameters, the owner considers the job a success. The areas of failure primarily reflect the challenges associated with integrating coatings into the scheme of rapid construction: compressed inspection schedules, reliance on more sophisticated equipment, etc. Also, the project points to some critical issues that still must be pinned down by our community in the near future. These are, the specifics of surface preparation—how to deal with bugholes and appropriate concrete dewatering time prior to coating application. Also, properly dealing with interfaces between shop and field coating and non-coated areas of the structure is a key to success. The devil is in these details, as it appears the answers for 98% of the surface area do exist. ■

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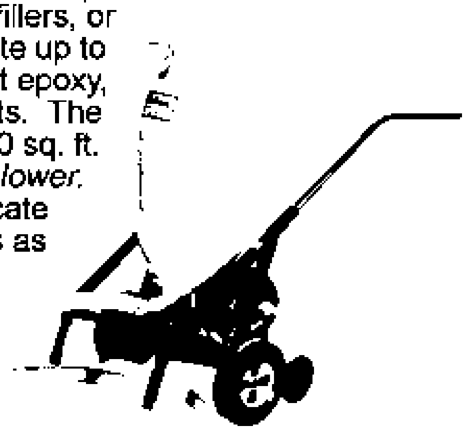

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PACE 2008 Mixed Tradition and Opportunity

PACE 2008 brought a wide variety of long-standing traditions and exciting new opportunities for attendees. This year's event drew over 3,000 attendees to the Los Angeles Convention Center in Los Angeles, CA, January 27–30 and featured over 180 exhibiting companies, 34 of which were first-time exhibitors. Highlights of this year's show follow.

SSPC Committee and Other Meetings

On Sunday January 27, SSPC Local Chapter Chairs met to discuss initiatives for 2008, such as chapter-delivered training, improving attendance at meetings, acquiring speakers, and attracting volunteers. According to SSPC, the dialogue focused on chapter-hosted training, what makes a chapter successful, and what SSPC can do to help chapters offer alternative training activities, such as webinars and other technology-based programs.

James F. Nyarady of the California Air Resources Board, Sacramento, CA, gave a presentation entitled "Architectural Coating Regulations in California," which focused on how California is addressing the need for more environmentally friendly coatings.

The Mega Rust follow up meeting included presentations from the Preservation Executive Oversight Group and working groups on costing, quality assurance, corrosion costs, heavy metals, paint/structures, and practical action. The meeting concluded with an afternoon discussion session, the Society reports.

The PCCP Advisory Committee held an open meeting on January 29. Chaired by Ben Remley of Techno Coatings, the event was attended by QP-certified and non QP-certified industrial contractors, facility owners, consultants, committee members, and other interested professionals. Discussions focused on the top ten audit deficiencies for 2007, announced and unannounced audits, and reporting of job notifications, SSPC says.

Education and Standards Work

Over 140 coatings professionals participated in the training programs offered by SSPC at the Westin Bonaventure. Courses included the new Protective Coatings Inspector Program (PCI), Applicator Train-the-Trainer Program, Marine Coatings, Fundamentals of Protective Coatings (C-1), Specifying and Project Management (C-2), Lead Paint Removal (C-3), Lead Paint Removal Refresher (C-5), and Airless Spray Basics (C-12).

4th Annual Facility Owners Breakfast at PACE 2008

SSPC announced a bold new step in the certification of coatings inspectors: the new SSPC Master Coatings Inspector program. The goal of the program is solely to recognize and honor those individuals whose experience and training has afforded them the prestige of multiple inspector certifications.

This year at PACE, SSPC offered three sessions covering various aspects of architectural coatings, including preservation, aesthetics and performance, the latest in coatings technology for green building practices; and a special session on architectural coatings for concrete. The sessions were the first at SSPC to be officially recognized by the American Institute of Architects (AIA), and those who attended were eligible for Continuing Education Units (CEUs).

SSPC conducted a casual and informal brainstorming session on Monday, January 28, to work with technical committee members on improving SSPC performance-based coatings standards.

Fundamentals of Protective Coatings (C-1) course students at the Westin Bonaventure, PACE 2008

Networking and Other Opportunities

Co-hosted by SSPC and SSPC QP-certified industrial contractors, the 4th Annual Facility Owners Breakfast provided more than 65 owner representatives with an opportunity to talk shop with their peers. The breakfast was held

Continued

Wednesday, January 30. Peer Forum meetings followed the breakfast.

More than 50 Protective Coating Specialists attended the 2nd Annual Protective Coatings Specialist Breakfast, held on January 29. Chairperson Wendy Amos, PCS, of Amos and Associates, presented a progress review of the Individual Certification Task Group. Highlights included an outline of the new PCS re-certification process.

In honor of his new book, *Selecting Coatings for Industrial and Marine Structures*, SSPC's long-time coatings authority, Dr. Richard Drisko, conducted a book signing at the PACE Bookstore on Monday evening.

2008 brought a different look to the SSPC booth in honor of both the location of this year's event and the important people who have made SSPC the respected organization that it is. The 2008 SSPC booth featured the Coatings Industry Wall of Fame, which honored past and present SSPC award winners. Honorees were invited to the booth to sign their placards, which will be displayed in SSPC's Pittsburgh headquarters.

SSPC would like to thank everyone who helped make PACE 2008 a success. PACE 2009 will be held February 15–18 in New Orleans, LA.

Four Companies Host SSPC Training Courses

SSPC C-1, Fundamentals of Protective Coatings, was held March 10–14, 2008, at the College of the North Atlantic in St. Johns, NF, Canada. Instructor Frank Palmer taught 18 students during the introductory course, which provides a practical and comprehensive overview for individuals who are new to the protective coatings industry. The course covers corrosion and corrosion control; coating types, their mechanisms, and protection; and preparing surfaces for painting.

The Lovelace Group sponsored the SSPC Lead Paint Removal (C-3) course at Stanley Consultants, Inc. in West Palm Beach, FL, on March 3–6, 2008. Nine students attended the course, which was taught by Chris Lovelace. The C-3 course focuses on the hazards of lead and other toxic metals that might be encountered on industrial painting projects. Discussions focus on protecting workers from lead exposures on painting projects; complying with environmental regulations; and developing programs to effectively control risks to workers, the public, and the environment.

SSPC instructor Mitch Blum taught

The NAVSEA Basic Paint Inspector (NBPI) course, hosted by the U.S. Navy Southwest Regional Maintenance Center in San Diego, CA, March 24-28

The Lead Paint Removal Refresher (C-5) course hosted by Industrial Corrosion Control in Mississippi, March 7

The Fundamentals of Protective Coatings (C-1) course hosted by the College of the North Atlantic in St. Johns, NF, Canada, March 10-14

SSPC, NACE Develop Joint Application Certification

SSPC and NACE International have developed a joint qualification standard titled "Industrial Coating and Lining Application Specialist Qualification and Certification." According to the associations, the standard explains the requirements for individual professional qualification and certification as it pertains to surface preparation and coating application for steel and concrete surfaces of complex industrial structures.

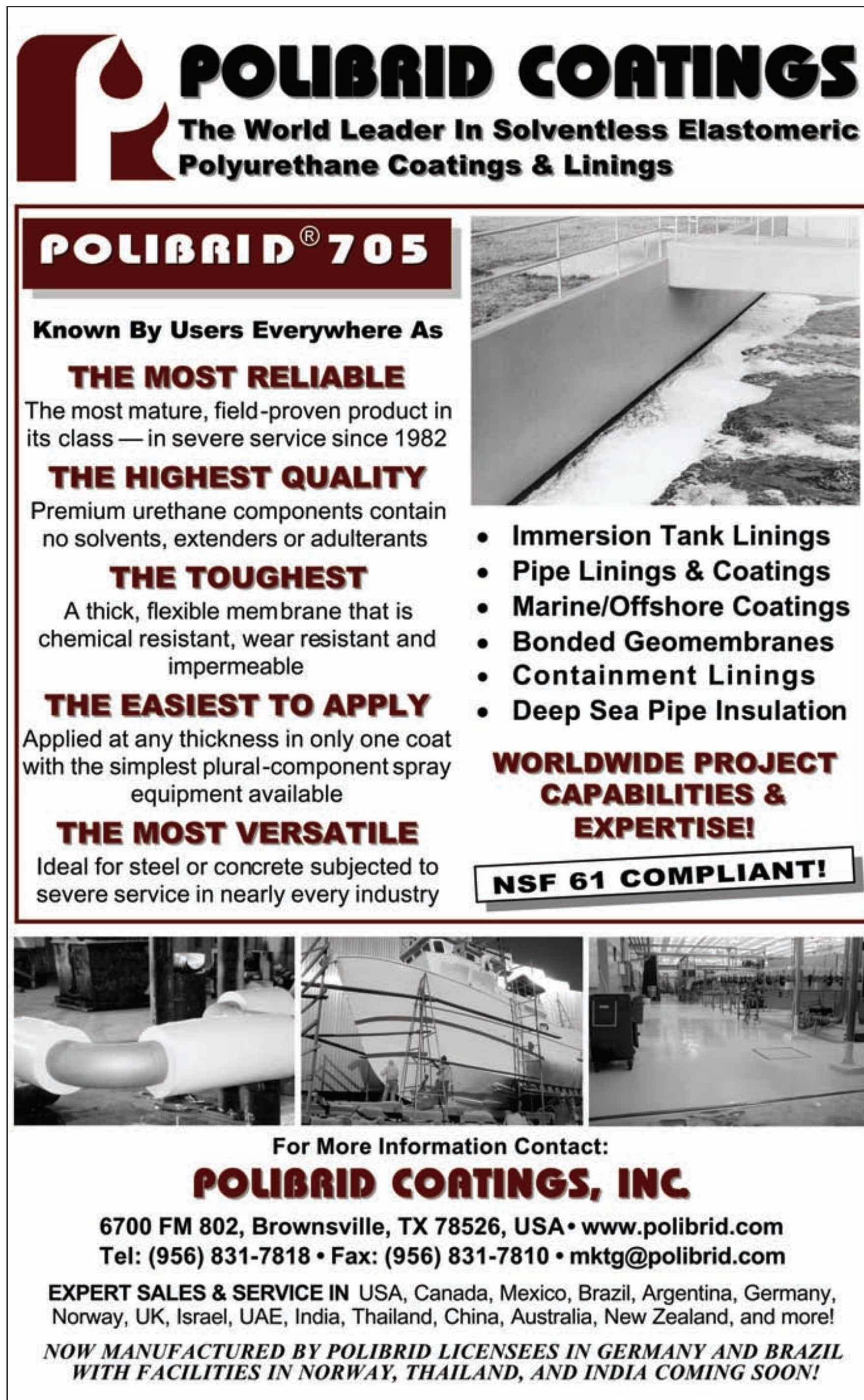
The joint standard is designed to qualify the capabilities of an individual application specialist through a broad range of classroom instruction, hands-on skills assessment, and associated work experiences. The standard may be used to develop programs for the education, training, certification, or assessment of coating applicators. It also can be used to validate a potential candidate's knowledge and skill level based on qualification in a certification program operated under this standard, the organizations report.

Continued

The Lead Paint Removal (C-3) course held at Stanley Consultants, Inc., West Palm Beach, FL, March 3-6

the Lead Paint Removal Refresher (C-5) course at Industrial Corrosion Control on March 7, 2008. Nine students attended the one-day course that provides refresher training for supervisors or competent persons who are responsible for industrial deleading operations. This is the second year in a row that the Mississippi-based company has hosted a C-5 course, SSPC reports.

The U.S. Navy Southwest Regional Maintenance Center in San Diego, CA, hosted an onsite NAVSEA Basic Paint Inspector (NBPI) course March 24–28, 2008. Earl Bowery and Gordon Kuljian instructed 20 students in the class. The NBPI course is a five-day QA course that was developed by Naval Sea Systems Command (NAVSEA) to train coatings inspectors to inspect critical coated areas as defined by U.S. Navy policy documents. The course also provides the technical and practical fundamentals for coating inspection work for steel structures other than ships, SSPC says.



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Unlike SSPC Qualifications Procedure (QP) standards, which state requirements for evaluating coating and lining contractors and inspection companies, the new joint standard states requirements for evaluating the individual coating application specialist in key areas, including environmental, safety, and health; process control; materials; surface preparation; and application.

Although SSPC offers training and certification programs for coatings professionals who plan, specify, manage, and inspect coatings projects, the program outlined by the new joint standard is the first of its kind to award recognition to the art and craftsmanship of the industrial coating applicator, SSPC and NACE report.

For more information, contact SSPC Standards Development Specialist Aimée Beggs: beggs@sspc.org.

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SSPC Chapters Reorganize, Plan Activities

The Three Rivers Chapter of SSPC has planned to hold its second annual golf outing on May 12, 2008, at the Quicksilver Golf Club in Midway, PA. According to SSPC's Lorena Walker, registration for the event was to begin at 7:30 a.m., and a shotgun start was to begin at 9:00 a.m. The $90 fee will include 18 holes of play, a cart, lunch, dinner, and prizes.

In other chapter news, SSPC's Arizona and South Carolina chapters, which were previously inactive, are in the process of re-organizing. For more information on getting involved, contact the following—Arizona Chapter: Jeff Mowbray, Sherwin-Williams, jkmowbray@msn.com; South Carolina Chapter: Michael Pilley, Phillips Industrial Services Corp., mpilley@phillipsindsvc.com.

For more information on the SSPC Chapter Program, contact Lorena Walker at 412-288-6034; email: walker@sspc.org.

Eleven Companies Join SSPC

The following companies joined SSPC as new Patron Members from January 1 to January 31, 2008. For more about joining SSPC as a corporate member, contact SSPC's Member Services Department at 877-281-7772.

- BASF Corporation, Wyandotte, MI
- Beam, Inc., Poca, WV
- Draygon Enterprises, Webster, NY
- Fox Brothers Painting, Bakersfield, CA
- Hall Industrial Contracting, Ltd., Blackfalds, AB, Canada
- Hyperion Technologies, Inc., Calgary, AB, Canada

New companies cont'd on p. 51

SSPC Individual Member Update

Below is the list of 36 new individual members who joined SSPC in February 2008.

If you have questions about joining, contact Terri McNeill at 877-281-7772 (U.S. and Canada) or 412-281-2331, ext. 2233.

- Kristopher Barton, Naples, FL
- Dominic Bergeron, St-Celestin, QC, Canada
- Eddie Blossman, Poplarville, MS
- Fernando Cardenas, Buenos Aires, Argentina
- Erwin Deger Asturias, Santa Catarina Pinula, Guatemala
- Jeremy DelMar, Bellevue, WA
- Alexei Fedorov, Moscow Russian Federation
- Remona Foster, Anchorage, AK
- Lydia Frenzel, San Marcos, TX
- Mike Gabel, Anchorage, AK
- Eric Guyer, Menlo Park, CA
- Lee Hanson, Duluth, GA
- Bill Hearn, Kingwood, TX
- Albert Hodges, Portsmouth, VA
- Daniel Janulek, Wasilla, AK
- Bryce Kale, Deerfield, IL
- Dale Krause, Irmo, SC
- Steve Lee, Juneau, AK
- Ping Li, Oak Park, CA
- Raymond Liddic, Baltimore, MD
- Suzanne Lovelace, Duluth, GA
- Steven Maass, Coral Springs, FL
- Joseph Matteucci, Wildwood, NJ
- Greg Mullins, Louisville, KY
- Carl Parrack, Clifton Hill, MO
- Robert Patrick, Ponte Vedra, FL
- Dale Pelger, Lima, OH
- Dale Ragan, Mount Vernon, WA
- Gilbert Rogers, Nisku, AB, Canada
- James Schwarz, Corpus Christi, TX
- Richard Sillner, Southington, CT
- Bryan Templeton, Mountlake Terrace, WA
- Phill Allen Tucker, Sulphur, LA
- Nathan Wheeler, Locust Valley, NY
- Jian Zhang, London, UK (GB)
- Luis Zuloaga, Lima, Peru

New companies cont'd from p. 50

- Rahm Industrial Services, Inc., Caledonia, MI
- Skinner Painting and Restoration, Piqua, OH
- Specialty Polymers, Woodburn, OR
- Steel Management System, LLC, Nazareth, PA
- Urbitran Associates, Inc., Scranton, PA

Look for more news on SSPC training courses and chapter activities in next month's *JPCL*.

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IBC Celebrates 25th Anniversary

The International Bridge Conference (IBC®), to be held June 2–4 in Pittsburgh, PA, marks its 25th anniversary as a prominent event for the bridge industry in North America, Europe, and Asia. Sponsored by the Engineers' Society of Western Pennsylvania (ESWP), the annual conference attracts over 1,200 bridge owners and engineers, senior policy makers, government officials, bridge designers, construction executives, and suppliers from throughout the U.S. and abroad. The IBC provides a forum for the exchange of information on the design, engineering, and maintenance of bridges, as well as an exhibition of industry-related products and services. The technical program for this year's IBC will feature over 80 sessions.

This year is the debut of the event's new venue—the David L. Lawrence Convention Center. According to ESWP, the new location has allowed major changes in the Exhibit Hall, expanding to 165 booths.

This year's featured agency, the Federal Highway Administration (FHWA), has developed presentations dealing with the federal-aid highway program and other topics, says ESWP.

The 7th Street Bridge, spanning the Allegheny River in Pittsburgh, PA. Photo by Jeff Greenberg, courtesy of VisitPittsburgh

SSPC Coatings Workshop

SSPC: The Society for Protective Coatings, will sponsor a coatings workshop at the IBC. Some of the highlights of this workshop include the following presentations.

- 20-Year Performance of Bridge Maintenance Systems—Peter Ault, P.E., and Christopher L. Farschon, Elzly Technology Corporation and Corrpro Companies
- The Curse of the Mummy: Strange Discoveries in the World of Coating Failures—Mike O'Donoghue, ICI Devoe Coatings
- One Hundred Years of Paint Performance: Fact or Fiction?—Eric S. Kline, PCS, KTA-Tator, Inc.
- Digital Data Management—Joseph Walker, Elcometer Instruments Limited
- Concrete Bridge Coatings in Kentucky: Progress in Lab and Field Testing Results—Derrick Castle and Dee L. McNeill, Kentucky Transportation Cabinet and The Sherwin-Williams Company

Exhibitors

Exhibitors of interest to professionals in the industrial and maintenance coatings field include the following. A brief description of each company and its booth number appear after the company name.

- BASF Construction Chemicals, LLC supplies chemical systems and formulations to customers from the ready-mix, prefabrication, and concrete products industries. Booth 608
- Corrpro Companies, Inc. offers cathodic protection and coating services for corrosion protection of steel and concrete structures. Booth 17
- Euclid Chemical Company manufactures polymer bridge deck overlay systems and epoxy adhesives and coatings, as well as a line of concrete repair and restoration materials. Booth 9
- Greenman-Pedersen, Inc./SG Pinney Instrument Sales, Inc. is a national engineering/architectural

design and construction firm that provides multi-discipline services to various industries. SG Pinney Instrument Sales, Inc., a GPI company, specializes in corrosion instruments and safety equipment. Booth 302

• Harcon Corporation provides bridge access equipment and rigging services to consultants performing bridge inspections and contractors performing bridge maintenance. Booth 110

• KTA-Tator, Inc. is a consulting engineering firm specializing in protective coatings, lead paint abatement services, and welding inspection. Its latest instrumentation for the non-destructive testing of concrete structures will be demonstrated at the IBC in a half-day Special Interest Session titled "Non-Destructive Testing of Aged Concrete." Booth 20

• Non-Destructive Testing Group provides bridge fabrication inspections for steel and concrete prestressed bridges, NDT inspections on existing bridges, and bridge paint inspections. Booth 509

• Portland Cement Association (PCA) provides programs on market development, education, research, government affairs, and technical services in the U.S. and Canada. Booth 304

• Precast/Prestressed Concrete Institute (PCI) is an association of producers, suppliers, and professionals dedicated to fostering greater understanding of the design and use of precast and prestressed concrete. Booth 303

• Sherwin-Williams Company manufactures coatings for concrete, metal, and other substrates, serving the maintenance coating, construction, industrial, automotive, and aerospace sectors. Booth 510

• Sika Corporation Construction Products Division manufactures a product line that includes protective coatings, concrete admixtures, sealants, adhesives, total corrosion management products, and epoxy resins. Booth 4

• Stirling Lloyd Products, Inc. offers the Eliminator, a sprayed bridge deck waterproofing system, for highways with asphalt overlay and railroads without protection board. High-performance anti-skid systems and polymer concrete overlays are also offered. Booth 514

• Termarust Technologies manufactures high-performance anti-corrosive coatings for steel/metal structures such as bridges, towers, and cables. Booth 310

For more information, contact ESWP, 337 Fourth Avenue, Pittsburgh, PA—tel: 412-261-0710; email: eswp@eswp.com. To register for the event, visit the website www.eswp.com/bridge/.

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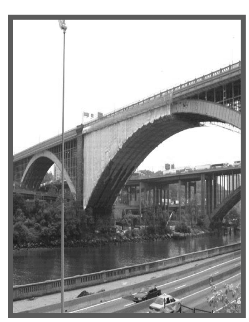

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AWWA Annual Show in Atlanta

The American Water Works Association (AWWA) will hold its Annual Conference and Exposition (ACE08—The World's Water Event®) on June 8–12, 2008, at the Georgia World Congress Center in Atlanta, GA. The event, which consists of a professional program as well as a an exhibition showcasing the goods and services of over 500 companies, has an intended audience of water treatment plant operators and managers, scientists, environmentalists, manufacturers, academicians, regulators, and others who hold interest in water supply and public health. The professional program, comprised of over 570 presentations representing the work of more than 1,000 experts in the water industry, is described as highlighting cutting-edge research and exceptional best practices.

AWWA is an international nonprofit and educational society that provides information and advocacy to improve the quality and supply of water in North America and beyond. It has more than 60,000 members, including more than 4,600 utilities that supply water to roughly 180 million people in North America.

For more information, please contact AWWA customer service at 800-926-7337 (303-794-7711 if outside the U.S. and Canada) or email: custsvc@awwa.org. To register, visit the website: www.awwa.org/ace08/.

Several companies of interest to professionals in the field of industrial and maintenance coating will exhibit at ACE08. Below is a list, as of press time, of those companies; booth numbers follow.

- 3M Company 202
- Ameron International 1601
- Arch Chemicals, Inc. 2630
- BASF Corporation 2807
- C.I.M. Industries Inc. 2017
- Carboline 2440
- Chemline 3006
- Corrpro Companies, Inc. 723
- Dow Chemical Co (The) 1249
- EPMAR Corporation 102
- Enviroline Group 3000
- Induron Coatings Inc. 1442
- MAB Paints 2005
- Munters Corporation-
  Moisture Control Services ...2116
- Rhino Linings 1935
- Sherwin-Williams 1835
- Tnemec Co. Inc. 409
- Tank Industry Consultants 515
- Tek-Rap Inc. 2117
- Wasser Corporation 1245

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Products

DTM Coating for Buried Steel Structures

Dow Hyperlast has introduced HYPERKOTE™ 610, a primerless direct to metal (DTM) protective coating for buried steel structures such as tanks, pipelines, lamp-posts and marine applications including bulk cargo holds.

Designed for application via generic high-pressure spray equipment, HYPERKOTE 610 was developed primarily to protect against corrosion in bulk cargo internal holds which require a high abrasion and impact resistant coating to withstand damage from abrasive materials such as coal, granite and bauxite.

The coating's smooth, glass-like finish produces a low coefficient of friction coating, which minimizes impact effect and eases the flow of materials in container loads, the company says. Minimal surface imperfections also help to prevent the build-up of dust and contaminants that could hinder the movement of container contents, the company adds.

The coating is described as a fast setting, moisture-tolerant, solvent-free, high-build system. According to the company, it is resistant to moderate concentrations of a large number of acids and alkalis and is suitable for applications requiring fast setting systems resulting in minimal downtime.

For more information about the product, contact Dow Hyperlast, Station Road Birch Vale, High Peak, Derbyshire SK22 1BR UK—tel: +44 1663 746518; website: www.dowhyperlast.com

Army Researches and Tests 'Green' Paint

A new coating system being made available for the Army's use to paint aircraft and other equipment performs better than the standard system and is safer for humans and the environment, according to the Connecticut Army National Guard at its 1109th Aviation Classification Repair Activity Depot (AVCRAD). The new system caps two

Continued

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years of research and testing by the 1109th AVCRAD on trivalent chromium-based primers and sealers.

Chromium has long been used in paint to create dense, protective coatings. In its hexavalent form, however, chromium is a known carcinogen. Although the Army has used chromium-6-based paint safely to protect and extend the life of its expensive equipment, it sought an alternative that was less potentially harmful to human health and the environment.

Then, in 2006, the Occupational Safety and Health Administration released more stringent regulations for permissible exposure limits of chromium-6. The Connecticut Army National Guard's 1109th AVCRAD decided to develop a green alternative to its standard chromium-6 paint system.

The result is a chromium-3- and water-based chemical agent-resistant coating system that leaves a smoother finish than the old system and is more resistant to fading and chalking, which minimizes the need for cosmetic painting.

It also reduces the use of hazardous materials, the release of potentially harmful air emissions, and the harmful chemicals present during disposal, according to the 1109th AVCRAD.

The new system has earned the 1109th AVCRAD the Army's highest honor in environmental stewardship: the Secretary of the Army Environmental Award, which was presented April 4, 2008.

New Version of Coating Calculator Available

Safinah Ltd, has announced that the latest version of its Coating Calculator software is available free to download on its website, www.safinah.co.uk/calculator_update.

According to the Morpeth, UK-based company, the Coating Calculator allows calculations for painting ships or other painting projects. The software can calculate the area of underwater hulls of ships, coating spread rate, and the weight of an applied coating.

New Surface Roughness Comparator

TQC has introduced a new comparison standard in accordance with ISO 8503 Part 1. Made of quality steel, the reference comparator indicates the surface condition of blasted steel as fine, medium, or coarse. Two versions are available, Model G, for grit blasting, and Model S, for shot blasting.

For more information, contact Thermimport Quality Control, email: info@tqc.eu; website: www.tqc.eu/.

New High-Performance Coating with Very Low VOC

International Paint LLC, an Akzo Nobel company, has introduced two new ultra-low VOC, 100 g/L coatings for-

Coming Up

Meetings

May 20 SSPC Hampton Roads Chapter Meeting, Hampton, VA, U.S., www.sspc.org

May 20–22 53rd Appalachian Underground Corrosion Short Course, Morgantown, WV, U.S., www.aucsc.com

May 20–23 NPRA Reliability & Maintenance Conference, San Antonio, TX, U.S., www.npradc.org

May 27 SPE: 4th International Oilfield Corrosion Conference, Aberdeen, UK, www.spe.org

June 1–5 AASHTO Subcommittee on Bridges and Structures, Omaha, NE, U.S., www.aashto.org

June 2–4 ESWP 25th Annual International Bridge Conference®, Pittsburgh, PA, U.S., www.eswp.org

June 2–5 NPCA: American Coatings Show, Charlotte, NC, U.S., www.paint.org

June 8–12 AWWA 2008 Annual Conference and Exposition (ACE 08), Atlanta, GA, U.S., www.awwa.org/ACE08/

June 11–13 TAPPI: 10th Advanced Coating Fundamentals Symposium, Montreal, QC, Canada, www.tappi.com

June 17–18 ASTM International Committee G03 on Weathering and Durability, Vancouver, BC, Canada, www.astm.org

Courses

May 19–23 UMR Short Course: Intro to Paint Formulation, Rolla, MO, U.S., web.umr.edu

May 26–30 SSPC C-2 Specifying & Project Management Course, Melville, NY, U.S., www.sspc.org/training

June 2–3 SSPC C-12 Airless Spray Basics, Chesapeake, VA, U.S., www.sspc.org/training

June 9–10 EMU Short Course: Improving Product Quality and Productivity, Ypsilanti, MI, U.S., www.emich.edu/public/coatings

June 9–13 NACE Basic Corrosion, Houston, TX, U.S., www.nace.org mulated specifically for the new construction, industrial maintenance, and repair markets.

Under development for more than two years, Interthane™ 2100 polyurethane finish and Interseal® 1100 surface tolerant epoxy deliver strong performance and application capabilities, while meeting the strict 100 g/L air emission standard as set forth by California's South Coast Air Quality Management District (SCAQMD), according to the company.

Interthane 2100 is a highly durable, two-component, high-solids polyurethane finish that provides good gloss and color retention in a variety of new construction and industrial environments, the company says. The finish is available in a wide range of colors.

Interseal 1100 is a two-component, high-build, anti-corrosive epoxy coating that can be applied as a single or multi-coat system over abrasive blasted, hydro blasted, or mechanically prepared steel surfaces. The product has a high degree of tolerance for application to damp surfaces, the company says, and unlike most high-solids epoxies, the primer does not require specialized equipment for application.

"Our commitment to this level of technological development is a matter of responsible manufacturing," said Chris McMillan, International Paint's product development and marketing manager, Americas. "As the regulatory demand for more cost-effective, green products continue to rise throughout the U.S., so does the demand from specifiers and end users for better corrosion protection and applicability in the field."

For more information, contact the company, 6001 Antoine Dr., Houston, TX 77091-3503; tel: 713-682-1711; fax: 713-684-1554.

Send news about your company or products to Karen Kapsanis, *JPCL* Editor, kkapsanis@protectivecoatings.com

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Extreme Coatings Wins Dam Painting Project

By Brian Churray, PaintSquare

Extreme Coatings, Inc. (Pasco, WA) was awarded a contract of $219,474 by Pend Oreille County Public Utility District No. 1 to recoat steel spillway gates and trashracks at the Box Canyon Project, a 160-foot-long by 62.4-foot-high concrete gravity dam on the Pend Oreille River in Ione, WA. The project involves abrasive blast-cleaning and recoating two 42-foot-wide by 20-foot-high steel spillway gates in place, as well as abrasive blast-cleaning and recoating two 19-foot-wide by 11-foot-high steel trashracks that will be removed and recoated in the parking lot.

Mansfield Industrial Secures Marine Terminal Coating Contract

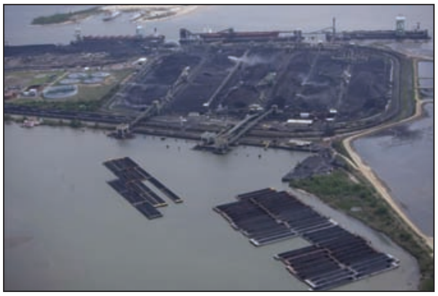

Photo courtesy of the Alabama State Port Authority

The Alabama State Port Authority has awarded Mansfield Industrial, Inc. (Theodore, AL) a 1-year term contract to perform surface preparation and coatings application at the McDuffie Island Terminal. The contract, which requires SSPC-QP 1 certification, includes recoating various terminal equipment, including ship loaders, cranes, barge loaders and unloaders, and conveyor transfer towers. The surface preparation includes testing for chlorides, sulfates, and nitrates and performing as-needed remediation. The metal surfaces will be abrasive blast-cleaned and recoated with a dry-fall epoxy spot-primer, an epoxy intermediate, and an aliphatic urethane finish. The contract, which also requires furnishing a NACE-certified coatings inspector, is valued at $75,030.

Mississippi DOT Lets Bridge Painting Project

The Mississippi Department of Transportation awarded Superior Contracting, LLC (Lorman, MS) a contract of $191,000 to recoat existing truss span surfaces on a bridge over the Yocona River. The contract involves recoating approximately 19,800 square feet of steel beams, railings, and trusses, including 12,950 square feet above the deck and 6,850 square feet below the deck.

Lindner Painting Wins Generating Station Tank Painting Project

The City of Grand Island, NE, has awarded Lindner Painting, Inc. (Seward, NE) a contract of $59,700 to clean and recoat the interior and exterior surfaces of a 20-foot-diameter by 22-foot-high raw water tank and the exterior surfaces of a 75-foot-diameter by 31-foot-high fire water tank at a generating station. The interior surfaces will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and lined with an epoxy system. The exterior surfaces will be power-washed, power-tool cleaned (SSPC-SP 3), and coated with an epoxy-urethane system.

Utility Service Company Awarded Tank Rehabilitation

Utility Service Company, Inc. (Perry, GA) was awarded a contract of $92,000 by the City of Tallahassee, FL, to repair and recoat an existing 100,000-gallon spheroid elevated water storage tank. The project includes cleaning and recoating interior and exterior surfaces. The exterior will be pressure-washed, spot abrasive blast-cleaned, and coated with a surface-tolerant epoxy spot-primer, a surface-tolerant epoxy intermediate, and an aliphatic urethane finish. The interior wet surfaces will be abrasive blast-cleaned and lined with a zinc-rich urethane primer and two coats of epoxy finish. The interior dry surfaces will be pressure-washed and coated with a surface-tolerant epoxy spot-primer and an acrylic finish.

Photo courtesy of Utility Service Co. inspection report