Vol. 3 Issue 3 | 2017

Corrosion Exclusively

INSIDE:

- Silver Bridge collapse
- When all else fails, taking the next step
- Drone interest soars for corrosion & coating inspections
- Recommendation for increased durability of new marine concrete infrastructure

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Transvaal Galvanizers commissions the

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Transvaal Galvanizers was founded in 1984 by the Managing Director of Imab Engineering with the vision of creating a full turnkey operation when it came to the need for supply of corrosion protected steel articles. With Imab Engineering at the forefront, this expansion into the galvanizing industry would one day become the biggest galvanizing plant in Africa.

With Transvaal Galvanizers celebrating their 33rd birthday this year, it is time to look back, standing on the threshold of this milestone, to the journey that has led us here.

Over the last 33 years, Transvaal Galvanizers has galvanized over a million tonnes of steel. This is equivalent to 165 000 Bull Elephants OR 3 676 Boeing 747's OR 137 Eiffel Towers OR 68 Brooklyn Bridges.

While looking back we are extremely proud of our history and our heritage, but looking forward is much more important to us. One man that is always looking forward is the Director of Transvaal Galvanizers, Francesco Indiveri. With Mr Indiveri at the helm, Transvaal Galvanizers has expanded into new markets focusing extensively on renewable energy projects.

With this in mind as well as the need for a larger galvanizing kettle in the industry, Transvaal Galvanizers has commissioned the biggest galvanizing plant in Africa in 2017. The size of the kettle is 15.5m L x 2m W x 3.2m D. This will provide steel manufacturers in the industry the flexibility of manufacturing larger items whether it be structural, solar, piping, reinforcing to name a few, without the cost implications of double dipping, forcing costs of projects to rise.

Not only will our upgraded facilities provide for a much greater capacity being 10 000 tonnes per month, but they incorporate state of the art equipment aiding in a greener, more environmentally friendly galvanizing process from start to finish. The upgrade incorporates 16tonne crane capacity with the advantage of crane off loading and loading of trucks, to ensure more efficient deliveries and dispatches for our customers.

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We constantly aim to continually improve ourselves by adapting to changing times and markets whilst ensuring that we always stay focused on client satisfaction. It is this focus that has brought us to where we are today, and we know that this focus will take us to even greater heights over the next 33 years.

With qualified, experienced and driven personnel at our forefront, we are your one stop shop when it comes to corrosion protection.

Vol. 3 Issue 3 | 2017

Corrosion Exclusively

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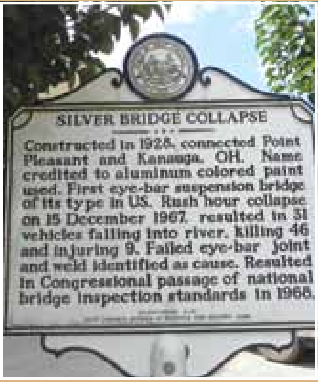
OFFICIAL MAGAZINE OF THE CORROSION INSTITUTE OF SOUTHERN AFRICA



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President's Comment

The Corrosion Institute of Southern Africa has been close to my heart for many years and I have seen the Institute flourish into what we see today.

The economic heartache South Africa finds itself in, has spilled over into many industries and The Corrosion Institute of Southern Africa has not been immune to these challenges.

We now find ourselves at a crossroad asking the following two questions:

- Do we remain as an Institute and brave the current tide?
  OR
- Do we become a professional body and invest, re-structure the Institute and take it along a road that will inevitably make it a relevant and current body in the competitive sector of corrosion?

During my pending Presidency, I have committed myself to carry on with the Corrosion Institute of Southern Africa's focus of transforming into a relevant corrosion focused body.

Our local courses have not been as popular as the NACE courses over the years however, with the pending SAQA Accreditations and the new BBBEE codes, I am confident that the CorrISA course offering will be very well supported in the twenty-four months ahead.

Much work has already gone into SAQA accrediting our very own Economics of Corrosion course with sixty-five university students thoroughly enjoying the CorrISA Course run at The University of Johannesburg in June 2017.

We also have a pending visit from our friends at NACE and discussions will take place on how CorrISA and NACE can strengthen our relationship even further in the years ahead.

I close my first Corrosion Exclusive comment with the following statement:

The road might be bumpy with many twists and turns, however I am confident that success awaits us near the end.

Donavan Slade, President

OBJECTIVE OF THE MAGAZINE

"The objective of *'Corrosion Exclusively'* is to highlight CORRISA activities, raise and debate corrosion related issues, including circumstances where inappropriate material and/or coatings have been incorrectly specified, or have degraded due to excessive service life. Furthermore, it shall ensure that appropriate materials or coatings, be they metallic or otherwise, get equal exposure opportunity to the selected readers, provided these are appropriate for the specified exposure conditions on hand."

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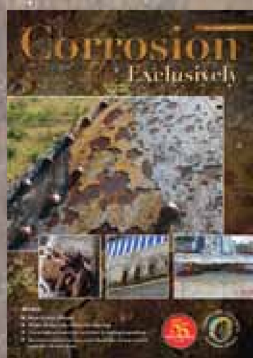


Cover: A failed organic coating system on a bridge in KZN; some corroding mooring chains in Kalk Bay; some groutless, corroding mast holding down bolts and spalling concrete along our coastline.

Editorial Comment

Not a day goes by in South Africa where we don't hear or read of some new form of corruption due to greedy government officials who by example, cowardly follow those who have in the past got away with wrongfully taking things that do not belong to them. Not doing anything about this could in the medium to long term bring this country to its knees. It is therefore incumbent on those officials who are currently not tainted by this malady of greed to conscientiously want to make a difference to the lives of the average citizen of this country to stand up and fight against these obnoxious people.

Similarly, corrosion affects every single citizen of this country and by not doing anything about it, will hasten the deterioration of valuable infrastructure. Those officials who are aware of it and do nothing to prevent further deterioration of the structures or those who repeatedly make use of out of date and therefore incorrect specifications, can be compared to those greedy government officials who will carry on regardless as long as no one responsible changes or improves the situation.

CorrISA convene monthly meetings where topics concerning corrosion and the prevention thereof are presented. Asset owners and specifiers are encouraged to attend these technical meetings to meet and afterwards freely network with members.

Having lived in Cape Town now for the last ten years I have got used to carrying my camera around and often am able to photograph some prematurely corroding material, which with a bit of foresight and correct advice could have been prevented.

It gives me immense pleasure to know we are now in our eighth edition of Corrosion Exclusively and extremely excited recently to have met with Pamela Nicoletti, Director of Education from NACE who showed great interest in our publication. We look forward to her future input.

We once again wish to thank all the contributors and advertisers, without whom the magazine would not be successful.

We encourage local participation and accept interesting contributions from overseas corrosion related organisations and individuals. We anticipate that in time this will add value to a reader's experience and simultaneously enhance the publication's credibility.

The following articles have been selected for inclusion in this eighth edition:

- Silver Bridge collapse.
- When all fails – taking the next step, by Mike O'Brien.
- Drone interest soars for corrosion and coating inspections, by Ben DuBose of NACE.
- Recommendations for increased durability and service life of new marine concrete infrastructure, by Keith Mackie.
- Coating quality control – concrete substrates, by David Beamish of Defelsko Corporation.
- Transformation of the Persoz & König pendulum hardness testing of coatings by Elcometer.
- Can galvanized and black steel reinforcement be used together in concrete? by Stephen Yeomans, Professor at Canberra University, NSW, Australia.
- Fine blasting abrasives come of age, by Charles Dominion.
- From the KETTLE, a regular contribution.

Graham Duk and Mark Terblanche together with Karyn Albrecht the Western Cape and KZN joint chairmen respectively give account of their activities.

Tim Henning of THCPS in KZN, gives us an account of his professional life in preventing corrosion in "The RUST Spot".

Should a reader wish to comment on any of the previously published articles or select a specific subject for discussion in a future edition of the magazine, kindly contact me?

Terry Smith

Silver Bridge collapse

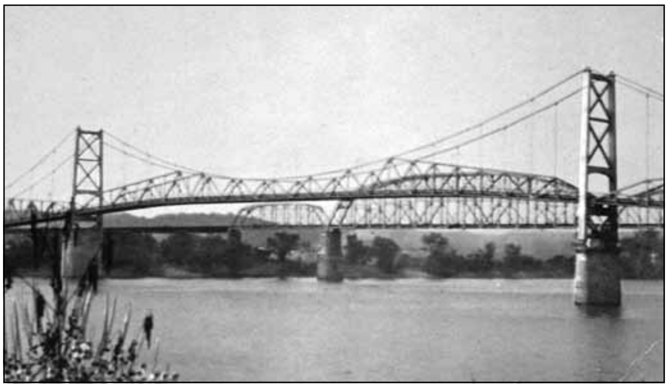
On December 15,1967 at approximately 5p.m., the U.S. Highway 35 bridge connecting Point Pleasant, West Virginia and Kanauga, Ohio suddenly collapsed into the Ohio River. At the time of failure, thirty- seven vehicles were crossing the bridge span, and thirty-one of those automobiles fell with the bridge. Forty- six individuals perished with the buckling of the bridge and nine were seriously injured. Along with the numerous fatalities and injuries, a major transportation route connecting West Virginia and Ohio was destroyed, disrupting the lives of many and striking fear across the nation. *(Reference: West Virginia Historical Society Quarterly Vol. XV, No. 4 October, 2001 The Collapse of the Silver Bridge by Chris LeRose).*

The General Corporation and the American Bridge Company constructed the Highway Bridge in 1928. It was designed as a two-lane eye-bar suspension type bridge, measuring 2 235 feet (681m) in total length, including the approaches. The bridge was designed under the specifications set forth by the American Society of Civil Engineers.

The bridge was dubbed the 'Silver Bridge' because it was the country's first steel bridge to be painted using a bituminous aluminium paint. It was designed with a twenty-two foot (6.7m) roadway and one five-foot (1.52m) sidewalk. Some unique engineering techniques were featured on the Silver Bridge such as 'High Tension' eye-bar chains, a unique anchorage system, and 'Rocker' towers. The Silver Bridge was the first eye-bar suspension bridge of its type to be constructed in the United States. The bridge's eye-bars were linked together in pairs like a chain.

A huge pin passed through the eye and linked each piece to the next. Each chain link consisted of a pair of 2" x 12" (51 x 304.8mm) bars and was connected by an 11" (279.4mm) pin. The length of each chain varied depending upon its location on the bridge.

Some questions were raised when this design idea was brought forward. What if the two eye-bars did not share the 4 « million pound (1.8 million kg) load of the bridge equally? Would the eye- bars fail under the overloaded stress? The designers thought they had an answer. The answer come in



the type of material used for the eye-bars. The American Bridge Company developed a new heat-treated carbon steel to use on the construction of the Silver Bridge. This new steel would allow the individual members of the bridge to handle more stress. Along with the two eye-bars sharing the load, the steel could easily handle the 4 « million pound (1.8 million kg) load. The newly treated chain steel eye-bars had an ultimate strength of 105 000 psi (724 Mpa) with an elastic limit of 75 000 psi (517 Mpa) along with a maximum working stress of 50 000 psi (345Mpa). The eye-bars embedded into the unique anchorage were also heat treated for an ultimate strength of 75 000 psi (517Mpa), an elastic limit of 50 000 psi (345Mpa) and a maximum unit stress of 30 psi (0.2Mpa).

Because of the unique design of the structure, the anchorage design needed to be innovative. Bedrock was only found at a considerable depth, making the ordinary gravity type anchorage impractical. An unusual anchorage was designed consisting of a reinforced concrete trough 200 feet (61m) long and 34 feet (10.4m) wide filled with soil and reinforced concrete. The huge trough was supported on 405 sixteen inch (406mm) octagonal reinforced concrete piles in which the cable pull is resisted by the weight of the anchorage and by sharing the halves of the piles.

Another unique design technique used on the Silver Bridge was the 'Rocker' towers. The innovative towers, which had a height of 130 feet, 10$^{1}/_{4}$ inches (40m), allowed the bridge to move due to shifting loads and changes in the chain lengths due to temperature variations. This was done by placing a curved fitting next to a flat one at the bottom of the

piers. The rocker was then fitted with dowel rods to keep the structure from shifting horizontally. With this type of connection, the piers were not fixed to the bases.

For thirty-nine years the Silver Bridge stood, allowing passage across the Ohio River. With the previous inspections, no one conceived that the structure might fall and collapse into the riverbed. On that fateful December 15, 1967 evening, tragedy struck. Within seconds, the Silver Bridge had collapsed killing and injuring many individuals.

Many people were out buying Christmas trees, enjoying the holiday season, unaware of the disaster, until they heard the sound. Some individuals said, 'the sound of the collapse was like that of a shotgun.' For those who saw the bridge collapse, they said, "it looked like the bridge fell like a card deck." Whatever the case, when the structure fell, horror captivated the area and lives were changed forever.

Many heroic eyewitnesses tried to help the victims who fell into the water. Rescue crews were on the disaster scene within minutes and were able to save some of the people from drowning in the Ohio River. Witnesses indicated that many of the vehicles were floating downstream while passengers would beat on their windows trying to escape. One eyewitness described seeing a truck driver standing on the top of his truck cab yelling for help as his vehicle slowly floated downstream in the cold water. William Needham, a truck driver from Kernersville, North Carolina, barely escaped death. He was in the cab of his truck driving across the bridge, when the collapse occurred. He managed to survive, but his partner in the truck cab never escaped the water of the Ohio River. His partner was asleep in the rear cab and had strapped himself in for safety. When the bridge collapsed, he had no chance of escaping. Needham claims that the truck sank to the bottom and that he narrowly escaped. He broke the window to the cab, grabbed a box to help himself surface, and barely made it to the top of the water before he ran out of breath.

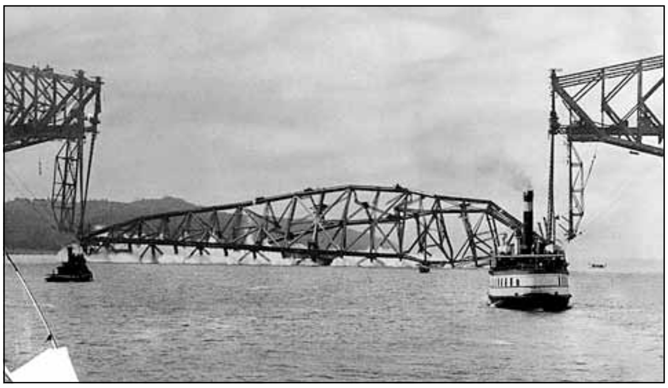
Another survivor, Howard Boggs, of Gailipolis, Ohio, lost his small family in the fall. His wife, Marjorie, and seventeen-month-old daughter were in their vehicle when the bridge collapsed. He claims that Marjorie noticed that the bridge was 'quivering' as they became stalled on the bridge in the heavy rush hour traffic. She then asked, "What will we do if this thing breaks?" The next thing Boggs remembers was scrambling for his life by breaking out his car window. Sadly, his wife and child perished in the accident. He could not aid them in their attempt to be freed from the sinking car. After the collapse, many residents questioned why the bridge would suddenly fall into the river below.

Three of the reasons that were commonly heard were:

- A supposed 'Sonic Boom' prior to the collapse.
- The 'Curse' of Chief Cornstalk.
- Structural failure of a bridge member.

The collapsed bridge needed to be thoroughly inspected before the cause could be determined. Without concrete reason for the bridge's failure, every suggested reason was researched until proven incorrect. Many people in the West Virginia and Ohio area claim to have heard a 'Sonic Boom' around the same time, or just moments before the bridge fell. Investigators checked with the nearby military installations, and there were no aircraft capable of producing a Sonic boom in the area at the time the bridge dismembered. The theory was proven false after the researcher's investigation showed that surrounding buildings were not damaged. If a sonic boom had occurred in a residential community, the overpressure would have caused extensive damage to homes and other structures in the Point Pleasant area.

Older residents claimed that the cause of the bridge collapse was 'The Curse of Cornstalk'. In 1774, the Battle of Point Pleasant took place between approximately 1 000 white men and 1 000 Indians. The commander of the Indian war party was Chief Cornstalk,



a well-respected and intelligent Indian leader. During the battle, Cornstalk could see that defeat was imminent for his forces. He therefore let his troops make a crucial decision, either to fight to the death or surrender. The Indian warriors chose to surrender. With the surrender, Chief Cornstalk signed the Treaty of Camp Charlotte. Chief Cornstalk and his son were later captured and murdered along with his son at Fort Randolph. Legend states that in his dying words Chief Cornstalk, still upset over his troops defeat, placed a curse of death and destruction upon the entire Point Pleasant area. Could this be the reason for the collapse of the Silver Bridge? After thorough investigations of the bridges' collapsed structure, 'The Curse of Cornstalk' was ruled out as a contributing factor to the collapse of the Silver Bridge.

After extensive studies of the broken structure members, the cause of failure was determined. The answer was the unique eye-bar design made from the newly innovated heat treated-carbon steel. The old saying, 'A chain is only as strong as the weakest link,' turned out to be a fact in the failure of the Silver Bridge. The heat-treated carbon steel eye-bar broke, placing undue stress on the other members of the bridge. The remaining steel frame buckled and fell due to the newly concentrated stresses.

The cause of failure was attributed to a cleavage fracture in the lower limb of eye-bar 330 at joint C13N of the north eye-bar suspension chain in the Ohio side span. The fracture was caused from a minute crack formed during the casting of the steel eye-bar. Over the years, stress corrosion and corrosion fatigue allowed the crack to grow, causing the failure of the entire structure. At the time of construction, the steel used was not known for subduing to corrosion fatigue and stress corrosion. Inspection prior to construction would not have been able to notice the miniature crack. Over the life span of the bridge, the only way to detect the fracture would have been to disassemble the eye-bar. The technology used for inspection at the time was not capable of detecting such cracks.

Stress corrosion cracking is the formation of brittle cracks in a normally sound material through the simultaneous action of a tensile stress and a corrosive environment. Combined with corrosion fatigue, which occurs as a result of the combined action of a cyclic stress and a corrosive environment, disaster was inevitable for the Silver Bridge. The two contributing factors, over the years continued to weaken the eye-bar and unfortunately the entire structure.

Another major factor that helped corrosion fatigue and stress corrosion in bringing down the bridge was the weight of new cars and trucks. When the bridge was designed, the design vehicle used was the model-T Ford, which had an approximate weight of less than 1 500 pounds (680kg). In 1967, the average family car weighed 4 000 pounds (1 818kg) or more. In 1928, West Virginia law prohibited the operation of any vehicle whose gross weight, including its load, was more than 20 000 pounds (9 090kg). In 1967, the weight limit almost tripled to 60 800 pounds (27 636kg) gross, and up to 70 000 (31 818kg) with special permits. Civil engineers must use a projected life span for nearly all projects, but no one could see that 40 years after the construction of the Silver Bridge that traffic loads would more than triple.

Although the collapse of the Silver Bridge was a major disaster in the West Virginia and Ohio areas, it also frightened the entire nation. The St. Mary's bridge, located upstream and similar in design to the Silver Bridge, was shut down for inspection after the collapse. President Lyndon B. Johnson ordered a nation-wide probe to determine the safety of the nation's bridges. In 1967 there were 1 800 bridges in the United States which were 40 years old including 1 100 highway bridges designed for Model-T traffic. Many federal officials feared that other structures, built around the same time to handle Model-T traffic, could face the same fate as the Silver Bridge.

Even though the collapse of the Silver Bridge was a disaster, there were positive aspects to the failure. Bridge inspections are now more routine and in-depth because of the Silver Bridge. Engineers are now more knowledgeable about corrosion fatigue and stress corrosion, which allows better quality structures to be designed and built. With today's technology, as well as better design techniques and materials, there is hope that a Silver Bridge disaster will never again take place.

Acknowledgement with thanks – Kingston Technical Software.

Elcometer transforms Persoz & König pendulum hardness testing of coatings

Manchester, UK (2017) – Measuring coating hardness is now more accurate, repeatable and reproducible than ever before, thanks to the new Elcometer 3045 Pendulum Hardness Tester.

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Simply fit the pendulum on to the loading pins, load the sample and close the door. The pendulum automatically moves to the start position, the sample table rises and the test begins.

Key features of the Elcometer 3045 pendulum hardness tester

- **Repeatable:** Once the sample is in position and the door closed, the unit completes a fully automated test at the press of a button
- **Accurate:** Performs a full calibration routine and automatically adjusts the unit to meet the specified standard – for confidence in the test results
- **Easy to use:** Simple menu driven operation in multiple languages
- **Adjustable:** With an integrated bubble level on the specimen table users can quickly identify whether or not the specimen table is correctly aligned and if required, simply adjust the rotating feet at the base of the unit.
- **Robust:** Sturdy, dustproof, and robust design ensures a stable environment for tests ensuring repeatable and consistent results. The rigid perspex door allows easy access for sample positioning and if opened during test a warning signal alerts the user and the test stops. The test will not begin again until the instrument is reset.
- **Powerful:** Batch memory stores all test data for output to PC via ElcoMaster® Data Management Software

The Elcometer 3045 Pendulum Hardness Tester can be used in accordance with: ASTM D 4366, BS 3900 E5, DIN 53157, ISO 1522, NF T30-016.

For more information on the Elcometer 3045 Pendulum Hardeness Tester, contact Elcometer at sales@elcometer.com or visit our website at www.elcometer.com

About Elcometer

Elcometer is a leading manufacturer of high quality inspection equipment, with specialised divisions dedicated to coatings inspection, ultrasonic NDT inspection, concrete inspection and metal detection. For information on our full range of products visit our website www.elcometer.com.

Infrared optical measurements of oscillations.

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Maximum sample size 200 x 110 x 14mm (7.85 x 4.33 x 0.55").

When all else fails – taking the next step

By Mike O'Brien

What is your response when the phone rings and the person on the other end informs you the material you selected, supplied, or applied is failing catastrophically? The most common responses include assuming it's not your problem and shifting the blame onto other parties… or making a commitment to determine the cause and helping to resolve it. What is your normal response?

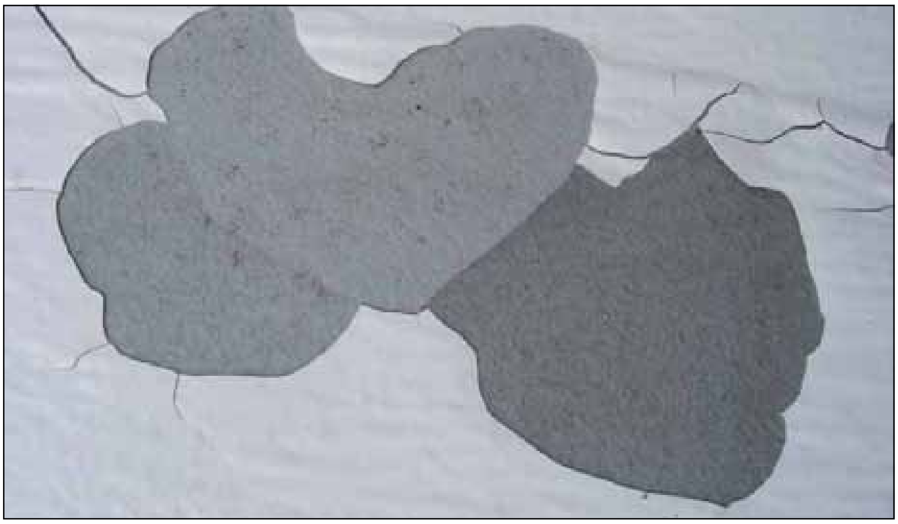
Regardless of whether you work for a paint supplier or a contractor, premature coating failures (PMCFs) are inevitable. CoatingsPro Magazine's "Never Again" articles regularly focus on premature coating failures in the hope that others learn from them and take steps to avoid similar problems. The goal of this article is twofold. First, to provide readers in the paint supplier and contractor communities with a basic roadmap for responding to that dreaded "failure notification" call. Second, to encourage each party to consider some common potential areas where the actions of their organization might have contributed to the failure in order to minimize the finger pointing and promote cooperation among the parties involved.

Over the years, the author has investigated numerous premature coating failures and generally two predominant initial opinions emerge from the involved parties. Some contractors quickly express their opinion that the coating material is defective either in manufacture or in formulation (i.e. bad batch). Conversely, paint manufacturer's representatives often assume the cause is on site and related to improper surface preparation or application problems. When both parties approach the problem with a presumption that their company has no responsibility, the focus unfortunately shifts from solving the problem onto affixing blame or attacking the other party.

Some universal principles never fail

Regardless of whether you are a contractor, a paint manufacturer's representative, or a specifier, there are some universal principles to follow when notified about a PMCF.

First, respond promptly in person or by phone. Remember the longer it takes to respond after a failure is reported, the more irritated the other party often becomes. Ask questions to determine the extent of the failure. Resist the tendency to prematurely diagnose the problem, especially over the phone. Prompt communication is essential. Set up a time to visit the site as soon as possible.



A defective raw material used in the manufacture of an aluminum epoxy mastic primer migrated to the top of the epoxy coating film. This resulted in disbondment of the polyurethane topcoat from an exterior tank.

Some contractors and paint suppliers become non-responsive and do not return or answer calls once a PMCF is reported. One contractor told the author that he learns a lot about the character of his local paint sales representative when PMCFs occur. Those who respond promptly, objectively, and open-mindedly, and then help develop fair, reasonable, and technically competent resolutions to PMCFs open new doors of opportunity with their grateful clients and bosses.

Second, set up a site visit to gain first-hand knowledge about the PMCF as soon as possible. Exercise an openminded approach and avoid the tendency of predetermining the cause before arriving at the site.

Third, during the site visit be quick to listen and slow to speak. Be prepared for opposing or neutral parties to ask what caused the problem shortly after your arrival on site. Exercise restraint, and do not draw conclusions too quickly or make strong, unsubstantiated, or defensive statements. Ask questions in a non-threatening manner with the goal of establishing facts. Suggested questions include the following: (1) On what date was the problem first observed? (2) Who reported it? (3) Where did the problem first manifest itself? (4) Was there an independent inspector onsite during the project, and if so, is a copy of the inspection report available?

Fourth, if warranted, request relevant documents, such as specification criteria, product data sheets, inspection reports, contractor's daily quality assurance records, and requests for information (RFIs). Look for patterns. Take some digital pictures if allowed.

Fifth, be very careful about e-mailing others to express your opinions regarding the PMCF, especially if your comments are based on a lack of testing or forensic evaluation. If your superiors require e-mail responses, limit your comments to objective, verifiable, factual statements and avoid verbose commentary. If litigation occurs, e-mails related to the case are usually ruled discoverable and must be produced when requested.

Sixth, determine if an independent third-party failure investigator is needed in order to determine the relevant issues in the hope of reaching an amiable and fair resolution. If so, attempt to reach an agreement between the parties on a mutually acceptable, well-respected, honest, and objective investigator. In some cases, particularly where litigation is likely due to the high estimated costs associated with repair or where one or more parties takes an uncooperative or hostile position, this approach will not work.

The broad principles stated above apply to all parties involved with a reported PMCF; however, there are some unique issues related to each party that require contractors, paint manufacturers, and specifiers to look at their own operations and potential liability before attacking the other party's practices. These issues are addressed separately for each party in the sections that follow.

Coating manufacturers – it's more than just the material

When PMCFs occur, contractors and owners often contact coating manufacturers' representatives to request assistance in determining the failure's cause. This puts the paint manufacturers in the middle of the situation and presents a conundrum, since their primary customer is the contractor who purchased the material. Some contractors hold paint manufacturers hostage under the threat of withholding future business if the paint manufacturer does not rectify the problem.

According to an article written by Mark Weston, and published in 2000 by PCE, based on an evaluation of PMCFs his firm investigated since 1993, the percentage of responsibility for each failure type were classified as follows: (a) faulty material (2%), (b) incorrect specification (41%), (c) application/installation errors (46%), (d) change in environment from original design criteria (11%).

At first glance, Weston's statistics might lead to the erroneous conclusion that coating manufacturers are responsible for only two percent of the PMCFs. If a paint manufacturer's representative arrives on site to look at a reported paint failure with the presumption that 98% of all failures are not related to his or her company, they might jump to wrong conclusions. It is important to remember that Weston concluded that 41 percent of coating failures result from incorrect specifications.

Poor spray application techniques used to apply a coating system on a corrugated interior roof resulted in low dry film thickness in some areas. The structure was open on the windward end and regularly subjected to ocean breezes. The coating deteriorated within six months in areas with insufficient dft.

Paint manufacturer's representatives regularly assist specifiers and owners with product selection and specification writing. Paint manufacturers also publish product data sheets (PDS) that contractors and specifiers rely upon. Some PDS' lack sufficient information and occasionally include ambiguous or misleading statements. Paint manufacturer's representatives occasionally write letters modifying the parameters listed on product data sheets. So in addition to manufacturing products, paint manufacturers are sometimes drawn into PMCF situations based on recommendations made by their representatives or statements contained within their PDS materials.

If you work for a paint supplier, take a long-range perspective when faced with a PMCF. Systemic process-related problems on the contractor's part might result in future occurrences of the same problem on other projects if the root problem is not addressed.

Just "paying for the problem to go away" is not the best approach. Some paint representatives are too quick to pressure their employers to take financial responsibility for the problem or risk losing future business opportunities with the client. Unfortunately, this quick and easy approach

Mike O'Brien

Mike O'Brien began his career in the coatings industry 38 years ago. In 1999, after working twenty years for two-large international coating manufacturers, he founded MARK 10 Resource Group, Inc., a firm specializing in serving the industrial coatings industry. Mike is currently on the Board of Directors for NACE International.

Mike regularly investigates premature coating failures, develops and delivers customized training programs, reviews and assists in specification development, performs job-site and plant audits and inspections, prepares expert reports, and serves as an expert witness in arbitrations, mediations and lawsuits.

Mike regularly speaks at national conventions on technical topics. He has published over 20 articles and is a regularly contributor for Coatings Pro Magazine, (a NACE International publication) often writing the Never Again article, providing practical help on how to avoid practices that result in premature coating failures.

Mike is a co-author of the10-year GTI study, which evaluated over 80 different girth weld coating systems on buried pipelines.

Mike is a NACE CIP Instructor, a NACE Level III Peer Certified Coating Inspector, an SSPC Certified PCI Inspector, and a SSPC Instructor for C1, C2, and PCI. He has taught coating or inspection related courses in 12 foreign countries, including South Africa.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CORROSION PROTECTION
Let us help you protect your assets by alleviating the adverse effects of corrosion over the long term. Our expert technical and specifications team are readily at your service.

A white, polysiloxane topcoat delaminated adhesively from an organic zinc-rich primer on a pressurized vessel at a gas processing facility. Additionally, the coating system installed in the field-joint area delaminated to the bare steel (as shown in the upper left portion of the picture).

does not serve the interests of any of the involved parties, including the contractor.

If improper technical practices by the contractor caused the problem and these practices are not identified and corrected, the same problem is likely to occur on future projects. The paint salesperson who is genuinely interested in their contractor customers wants to minimize future problems. To accomplish this goal, the root problem once identified must be discussed openly and honestly with all key management personnel in order to implement procedures to minimize the likelihood of reoccurrence.

Contractors – it's not just the material

When PMCFs occur, upper management personnel from the contracting firm typically contact the paint manufacturer and request assistance. Often the individual placing the call spent little time onsite while the work was ongoing. This means the information conveyed is based on second hand accounts communicated to management from the onsite personnel. In other words, the information might later prove incomplete or, in some cases, inaccurate. For this reason, it is best to talk directly to the site personnel if possible.

As mentioned earlier, contractors are prone to express their position that the problem resulted from defective paint. The implicit assumption is that the contractor's personnel performed all the required processes and tasks properly and in accordance with the specification and the PDS. However, when one considers all the processes and subsequent requirements that the contractor is responsible for monitoring regularly, it is amazing that more coating failures do not occur.

Applying today's environmentally friendly coatings requires a much greater level of monitoring on the contractor's part than in the past. Successfully applying industrial coatings nowadays demands more attention to detail at a time when paint contractors are finding it increasingly difficult to locate, employ, and retain qualified and experienced painters. In short, the coatings are more sophisticated and the applicators are less experienced. This is a formula for experiencing a dramatic increase in PMCFs.

For example, consider some issues the contractor must daily monitor. At a minimum, the contractor must store the paint in the proper ambient conditions, thin it (if required) with the proper amount and type of solvent, apply it at the proper film thickness within the proper ambient conditions and surface temperature parameters, and ensure the coating cures within the proper ambient conditions. In addition, the contractor must comply with the minimum and maximum recoat windows when applying multiple coats.

Before pointing the finger at other parties as the source of a PMCF, contractors are advised to examine their own operations closely in order to determine whether the actions of their personnel caused or are partly responsible for the failure. As the contractor, in terms of surface preparation, consider the following: Did you achieve the proper surface cleanliness level and surface profile depth? Did you monitor the air cleanliness used for abrasive blasting? If required, did you remove non-visible surface contaminants?

As the contractor, in regards to paint application, did you store the paint in the proper ambient conditions? Did you mix the paint for the required time? Did you use the correct type and correct amount of thinner? Did you mix the material in the proper ratio and in accordance with the paint manufacturer's instructions? If required, did you allow the proper induction time prior to application? Did you apply the paint within the specified ambient and surface temperature conditions? Did you allow it to cure in the proper ambient and surface temperature conditions? Did you monitor and observe the minimum and maximum recoat window parameters? Did you apply the paint at the proper dry film thickness?

Was your application equipment functioning properly? Was your inspection equipment properly calibrated and in good working condition? Are your personnel properly trained in the calibration and use of the inspection equipment and visual standards?

While some contractors quickly reply affirmatively to all these questions, many possess little or no documentation to demonstrate their personnel regularly monitored these processes. The lack of regular and credible documentation and record keeping often proves detrimental to a contractor when a PMCF occurs. In quality circles, it's commonly stated, "If it's not written down and documented, it didn't happen." Unfortunately some contractors do not monitor and many do not document their findings even if they are monitoring.

Establishing a process of requiring onsite personnel to regularly monitor and accurately record all required conditions, then training them to properly use the appropriate inspection equipment will likely decrease the number of PMCFs caused by the actions of contractor personnel and will likely prove instrumental in any PMCF investigation.

Summary

PMCFs often represent valuable learning opportunities if all parties direct their efforts toward determining the problem's root cause, without attempting to deflect or shift the blame. This requires a fair, disciplined, and objective assessment of each party's own responsibilities in the particular situation. If the parties agree on the problem's root cause, it is much more likely that an amiable and equitable arrangement for resolving it can be reached.

We wish to thank Mike O'Brien the author of this article as well as CoatingsPro, in which it was originally published.

Fine blasting abrasives come of age

Ecoblast® is a finely graded blasting abrasive developed with specific goals in mind; namely to achieve a superior quality surface finish for maximum paint adhesion at the lowest cost.

Typically, the blasting and coating industry has "got away with" using coarse blasting abrasives that provide surface profiles (roughness) well over 100 microns, sometimes up to 250 microns using standard commercially available abrasives. This is unnecessary and wasteful. Rough surface profiles do not provide better paint adhesion, contrary to popular belief and would also be wasteful in that excessive profiles need to be filled with expensive coating products before beginning to achieve specified paint film thickness. Undoubtedly, in most cases, the thinking behind this common practice is a result of the profoundly incorrect belief that coarse abrasives are required to remove stubborn coatings and corrosion products from surfaces that require cleaning.

The science of physics has clearly changed the way we live and we marvel at the multitude of scientific applications built on the foundations of work done by Isaac Newton, Michael Faraday, Max Planck and a host of other dreamers and intellectuals who have brought, and continue to bring technological innovation to our fingertips. Is it not time then, to ask why it has taken so long for the blasting and painting industry to embrace some simple principles of physics?

Einstein's equation $e=mc^2$ (energy equals mass multiplied by the speed of light squared) is acutely insightful and explains how the sun works, atomic bombs, radiation and the effective use of nuclear power. The roots of his equation go further back though, to the seventeenth century, to a Frenchman and playwright named François-Marie Arouet, exiled to Wandsworth in the UK from France for challenging a wealthy aristocrat. There, he discovered the works of Isaac Newton. Returning to France three years later he assumed the pen name of Voltaire (yes, the same Voltaire whose famous quotations we often read about) and by chance, could share his scientific passion and it would also seem, infatuation, with another eccentric scientist, Madame du Chatelet. Du Chatelet, as was customary at the time, took in Voltaire as her lover due to the prolonged absence of her husband, dispatched continuously away on military duties and the couple's affair also built a respected physics laboratory in Cirey, comparable to the Academy of Sciences in Paris.

It was at their laboratory in Cirey that they embraced the concept that Isaac Newton was wrong in one assumption that energy was not equal to mass X velocity but Energy was equal to Mass X velocity squared. The original thinking was not theirs. They were influenced by Gottfried Leibniz, a great German diplomat and philosopher but who had no physical proof that $E=mv^2$. The decisive proof came from a Dutch researcher, Willem 'sGravesande whose physical experimentation measuring the indentation in clay made by balls at different velocities brought the concept of $E=mv^2$ to being a reality.

Returning to the blast cleaning industry, how can we make use of $E=mv^2$? Assuming contractors use Laval (venturi) blasting nozzles that were designed to accelerate abrasive particles, we know that fine particles will accelerate more than coarse particles because they have less inertia and will exit the nozzle at much higher velocity. There is recorded proof of this phenomenon. Based on available data, it becomes quite clear that the energy transmitted to the substrate being blasted is far greater with many more fine particles at high velocity versus coarse particles (of the same mass). Efficiency in a nutshell! The finer the abrasive, the faster the particles travel and the greater the energy and cleaning efficiency transferred to the work surface. The only factors we need to worry about are; is the surface profile correct and is the abrasive harder than the substrate we are trying to take off (if the abrasive was softer it would be ineffective)?

Ecoblast® is designed for $E\text{-}mv^2$ and recent increased sales would suggest that fine abrasives have finally come of age!

Acknowledgment: Charles Dominion of Ecoblast®

Drone interest soars for marine corrosion, coating inspections

New partnerships aim to expand drone use for maritime asset maintenance

By Ben DuBose, Staff Writer, NACE International

Corrosion has long been a major challenge for marine asset owners and operators, with corrosion under insulation (CUI) near the forefront of the list. The abundant moisture found near marine assets can often become trapped around pieces of equipment and even within insulated material – leading to accelerated localized corrosion of the underlying metal substrate. Galvanic corrosion is widely considered the primary form of corrosion here.

In recent years, the idea of using unmanned aerial vehicles (UAV) – or drones – for surveillance operations to help spot such problems has surged in popularity across many industries, led by oil and gas and others prone to the effects of corrosion.[1] Traditionally, these inspections have been carried out by human crew members, surveyors, or independent inspectors – a risky activity that represents one of the most common causes of work-related industry fatalities. That risk is often further heightened in marine and offshore environments.

Besides the safety issue, these traditional practices may not always be completely effective. In the example of CUI, since removing all insulation material and examining the substrate underneath is cost prohibitive, the usual practice is to remove small portions of the insulation at select locations that could be at risk, and then use nondestructive testing (NDT) techniques on the surface to determine if there is metal loss. That practice, however, can sometimes spark a new problem by creating a potential entry point for moisture ingress. In addition, since CUI is localized, corrosion may not be found if the point where the insulation is removed is not covering the specific area where corrosion is occurring.

Drones, however, have shown the potential to help the process in multiple ways. First, they can access difficult, hard-to-access environments, which reduces the safety risk for human inspectors. Second, by using remote thermal infrared (IR) and multispectral imaging sensors, they can detect anomalies that can be indicative of corrosion – even without removing the insulation or the existing coating.

The concept of using drones for inspections is of particular interest to the maritime industry, since the marine environment presents numerous spaces that require either significant human risk or significant financial cost to access. However, as with many new technologies, challenges come with commercialization, costs, and processes.

To address those questions, a number of research and development (R&D) projects launched in recent months are aimed at facilitating a more widespread adoption of drone use to inspect for problems such as corrosion. These projects involve partnerships between industry, academia, and drone technology groups – all designed to develop new end-to-end processes to enable the frequent use of drones to perform inspections in maritime settings.

Enclosed spaces, ballast water tanks

One such collaboration announced earlier this year comprises global paints and coatings company AkzoNobel (Amsterdam, The Netherlands), oil and gas tanker operator Barrier Group (Wallsend, United Kingdom), and DroneOps (Morpeth, United Kingdom). Given the code name RECOMMS (Remote Evaluation of Coatings and Corrosion on Offshore Marine Structures and Ships), their project[2]

AkzoNobel, Barrier Group, and DroneOps joined a wave of collaborations aimed at promoting drone use to help with marine maintenance issues.
Photo courtesy of AkzoNobel.

One marine consortium led by Robotica in Maintenance Strategies (RIMS) has proposed enclosing their drone within a protective cage.
Photo courtesy of Flyability.

Under one proposal, data collected by drones could potentially enable engineers to monitor marine structures at a remote, land-based control center. Photo courtesy of Rolls-Royce.

aims to use the semiautonomous operation of a drone to assist with coating and corrosion checks.

With a goal of boosting safety, project officials say their drone will use advanced virtual reality technology to deliver safer, more accurate evaluations of many enclosed or difficult-to-access spaces on ships and marine structures, including ballast water tanks. Those evaluations will involve inspections of corrosion damage and any deterioration of the existing coating. The drone should be able to detect CUI and help identify the need for maintenance further in advance, according to the developers.

"Surveys of enclosed spaces and ballast water tanks are an essential part of routine maintenance and are increasingly critical for ship owners," says Michael Hindmarsh, business development manager for AkzoNobel's International Paint marine coatings business. "Inspecting these areas thoroughly can require working at height, entering confined spaces, and negotiating slippery surfaces that could be poorly lit, all of which are high-risk activities that the maritime industry is keen to address."

By replacing human inspections with a drone, routine maintenance can be monitored remotely and in real time by office-based staff, with instant feedback available to the vessel or offshore structure's superintendent, according to the companies. In turn, this can reduce costs, increase efficiency, and significantly reduce risks to human workers during essential maintenance.

The companies explain that the partnership's experience, which includes coatings expertise and consultancy, drone building, ownership of marine structures, and a working knowledge of present repair and inspection practices, provides a complete overview of issues and challenges associated with enclosed space inspections. As part of the partnership, additional coatings information will be provided by coatings consultancy Safinah Ltd. (Gateshead, United Kingdom).

AkzoNobel notes that is already using drone technology. The company is currently testing the use of drones in Australia for inspecting sites in remote locations – where access is limited and the movement of heavy equipment is difficult. Thus far, the results have shown significant promise, Hindmarsh says, with specific findings expected to be published later this year.

As the consortium pushes forward, the drone will undergo flight trials at an existing coatings test site in the United Kingdom and also at an indoor training facility run by the tanker operator. The drone's official completion and launch is planned for October 2017.

'Caged' drone

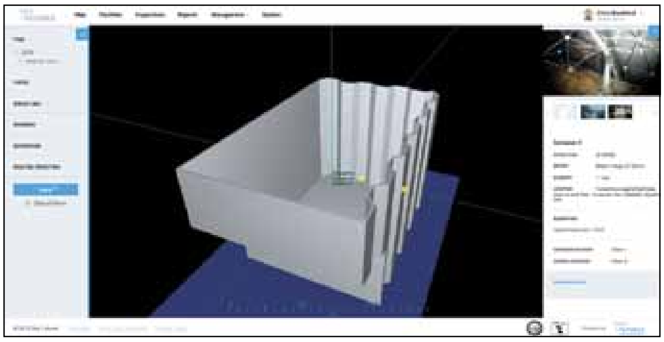
The RECOMMS project is the latest in the string of marine drone announcements. Earlier, in November 2016, Robotica in Maintenance Strategies (RIMS) (Rotterdam, The Netherlands) officially launched its own new service for the maritime and offshore industries using a dronewith a protective cage, named "Elios."

"We carried out extensive market research including visiting several universities in Holland and Switzerland with our partner Flyability

Ben DuBose, Staff Writer, NACE International

Ben DuBose has been a NACE International staff member since May 2016, serving as staff writer for both Materials Performance (MP) magazine and CoatingsPro Magazine. Before working at NACE, DuBose held the position of digital editor at Gulf Publishing Company for the magazines Hydrocarbon Processing and Gas Processing. So in addition to covering the corrosion control industry directly at NACE, that prior oil and gas experience allowed him to witness the massive impacts of corrosion on the energy sector – one of many very exposed to its effects. "Writing about corrosion is rewarding, because it really affects everyone and almost everything," he says. "Every industry vital to our society has infrastructure that needs proper maintenance to stand the test of time. I've seen it first-hand in oil and gas. It's easy to think about building new assets, but not everyone thinks about the importance of maximizing the lifespan of those assets, once they're in place. Through our stories, we at NACE bring awareness to corrosion threats and solutions that many around the world may not yet know of."

DuBose holds an M.S. degree in journalism from the University of Missouri and B.S. degrees in communications and political science from Lamar University. He currently resides in Houston, Texas, USA.



Drone firm Flyability is working with an inspection services provider to bundle drones with Expanse software to improve interpretation of the findings. Photo courtesy of Sky-Futures.

[Lausanne, Switzerland], where they gave a presentation of their drone Elios," says Senior Maintenance Engineer David Knuckell. "This is a drone within a protective cage, and is perfectly suited to enter enclosed spaces and carry out in-depth inspections of the enclosed areas."

The cage enables Elios to "bounce of walls" and "fly where no other drone can," according to Flyability, which used the drone in a case study[3] last fall to inspect a storage tank for oil and gas terminal operator Royal Vopak (Rotterdam, The Netherlands).

"We used to climb down, had to arrange all kinds of safety measures for people, and had to light up lamps to do the inspection," says Jan Zandberg, a terminal manager at Vopak. "Now we can use the drone, which saves us an enormous amount of time, but also lowers the risk of sending people down there. We now inspect the whole tank in about two hours. In earlier days, people had to go down, all kinds of precautions had to be made. This cost days."

"This technology has just started," he adds. "We see huge advantages to using this technique in the future. It will become a mainstream technology, I'm absolutely convinced of that."

For projects involving the Elios, the drone developer is working with global drone-based inspection services provider Sky-Futures (Hayes, United Kingdom) to bundle the drone with Expanse[†] software for interpretation of the findings. The software helps make data available to all stakeholders through a cloud system, and it enables clients to present inspection findings in a three-dimensional (3D) environment. According to the companies, the combination of the drone and software allows for an end-to-end solution of data capture, processing, and distribution.

"Through this bundle package, we intend to provide our customers with the greatest flexibility and efficiency in the way they can disseminate and post-process data gathered," says Patrick Thévoz, CEO and co-founder of the drone development company.

In June 2016, the two companies completed the world's first trial inspection of a floating production, storage, and offloading (FPSO) cargo tank by drone without using a human to enter the tank. According to Karen Cowie, BW Offshore's (Oslo, Norway) senior integrity engineer for the Athena FPSO in the U.K.'s North Sea, the drone was able to fly down into the tank unaided and accurately navigate the internal space for inspections.

"From the inspection completed, it is clear that the benefits in terms of not just time and cost to inspect but also preparation, cleaning, repeatability, and access requirements highlight that this technology is an exceptional tool to have available," Cowie says. "For our specific requirements, the safety benefit to be gained by avoiding personnel entry is invaluable."

Preprogrammed inspection missions

In September 2016, technical services and maritime classification organization Lloyd's Register (London, United Kingdom) signed an agreement[4] with drone company Airobotics (Petah Tikva, Israel) to help develop its own use of remote access technologies, including the use of autonomous drones for preprogrammed inspection missions.

In this collaboration, the drone company has developed a fully automatic platform that is continuously available on-site and enables both preprogrammed missions and expert access in an on-demand format. The platform is self-sustained, with an ability to replace its own batteries and payloads as required for different missions.

According to project officials, the payloads used on drone inspections include various capture devices such as high-definition video cameras that capture still shots for IR thermography, which is used frequently to detect CUI. Further technical capabilities available with their platform include 3D models and maps generation, with other sensors available upon request.

Looking ahead, the groups plan to focus on additional development within the platform's hyperspectral capabilities. Hyperspectral imaging works by obtaining the full spectrum for each pixel in an image, with a goal of covering a wider range of wavelengths than can be seen by the human eye and better detecting materials or patterns in the object being inspected.

"We believe our cooperation will open doors for the maritime industry to reveal a new level of efficiency and innovation with our automated, industrial-grade drone solution," says Ran Krauss, CEO of Airobotics.

Land-based control center

Meanwhile, in March 2016, integrated power and propulsion solutions provider Rolls-Royce (Derby, United Kingdom) unveiled its vision of a land-based control center to remotely monitor and control unmanned ships.[5] In a six-minute demonstration video, the company shows how the program would use surveillance drones to help monitor what is happening around a ship.

"We're living in an ever-changing world, where unmanned and remote-controlled transportation systems will become a common feature of human life," says Iiro Lindborg, general manager of the company's remote and autonomous operations segment within its ship intelligence division. "They offer unprecedented flexibility and operational efficiency."

"Our research aims to understand the human factors involved in monitoring and operating ships remotely," he adds. "It identifies ways crews ashore can use tools to get a realistic feel for what is happening at sea."

Partners on the land-based control center project include nonprofit R&D group VTT (Espoo, Finland) and the Tampere Unit for Computer Human Interaction (TAUCHI) research unit at the University of Tampere (Tampere, Finland).

Their project envisions using staff at a control center to plot a complete course for autonomous vessels – each with remotely piloted drones for inspection and predictive maintenance operations – before turning the process over to regional remote operators. The technology would enable a small crew of between seven and 14 people to monitor and control an entire fleet.

The groups involved in this joint research project plan to build a project demonstrator "before the end of the decade."

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† *Trade name.*

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REVIEW OF PIANC REPORT NO 162 OF 2016

Recommendations for increased durability and service life of new marine concrete infrastructure

By K.P. Mackie

Preamble

PIANC stands for "Permanent International Association of Navigation Congresses" and is a forum where professionals around the world join forces to provide expert advice on cost-effective, reliable and sustainable infrastructures to facilitate the growth of waterborne transport. Established in 1885, PIANC continues to be the leading partner for government and private sector in the design, development and maintenance of ports, waterways and coastal areas.

PIANC regularly publishes technical reports on various issues to do with Ports, Harbours and waterways. Downloads of these can be purchased on www.pianc.org

Objective and approach

As the title implies, the primary concern of this document is the integrity of reinforced concrete structures and, in this context, explicitly the deterioration caused by corrosion of the reinforcement. The net result is to examine the action of the concrete as anti-corrosion protection to the steel.

This approach covers both the design side, the design of the concrete mix and the detailing of the reinforcement and the construction side, the quality of construction and the accuracy with which the designs are implemented and the interaction between these two aspects.

The report is at pains to emphasise that it is NOT a code of practice for the design and construction of reinforced concrete structures. There are any number of good codes available that should be used and a plethora of regulations governing such structures.

The intention of the report is to convey an understanding of the corrosion processes and the basis of good practice in using these codes and standards.

The foundation of the study (Chapter 2) is a review of the causes and processes of corrosion of the steel reinforcement to concrete structures.

2. Durability and service life

2.1. Deterioration process

2.1.1. General

2.1.2. Corrosion of embedded steel

Chloride induced corrosion

It begins with a discussion of the manner in which the alkalinity of the cement paste creates a passivating protective oxide layer on the steel that prevents corrosion: of how the presence of carbon dioxide diffusing in from the atmosphere reduces the alkalinity and breaches the protective layer and of how the presence of chloride ions breaks the passivity of the protecting oxide layer. In combination, the lower the alkalinity, the less chloride is needed to initiate corrosion. Once the passivity of the steel surface is broken, the actual process of corrosion is dependent on the availability of oxygen diffusing into the concrete.

Carbonation induced corrosion

Besides the mix design, the type of cement used and the nature of the cement displacers, e.g. blast furnace slag, silica fume, have a significant effect on the rates of carbonisation. The effect is generally greatest at a relative humidity of 65%. In general, this effect is minimal for well-designed concrete.

Crack induced corrosion

The presumption is that cracks in concrete admit moisture, carbon dioxide, chloride and oxygen and can initiate corrosion. However, crack geometry is extremely complex: combined with a large variety of possible environments, research has been unable to develop a rational understanding of the process.

Other causes of reinforcement corrosion and cracking of concrete discussions are:

- Freeze-thaw resistance
- Alkali-silicate reaction (ASR)
- Chemical Seawater Attack
- Delayed Ettringite formation
- Early-age cracking
- Abrasion

Another issue not addressed in the report is surface ablation by crystallisation of salt just under the surface of the concrete. It usually occurs on dry, windy, arid shores where spray is blown onto the structure.

2.2. Codes and practice

Discussion focusses on recent developments in the use of cement displacers and the absence of guidance in their use in the codes where prescription is limited to water binder ratio and minimum binder content.

Keith Mackie

Keith Mackie established his practice in 1996 to specialize in this field of engineering

It is his mission to make available to both public and private sectors, the unique and enormous expertise he has acquired in a lifetime building and maintaining the suite of fishing harbours on the inhospitable coasts of Southern Africa. This involved the whole spectrum of projects, breakwaters, dredging, quays & jetties, dry docking and harbour services. His experience managing harbour maintenance has allowed him to assess the effectiveness of design standards used for projects in aggressive environments and in remote locations with limited technical back-up. As a result, he has a special interest in the sort of pragmatic solutions needed for a fishing industry and, in particular, in achieving an economic approach to small projects on exposed and remote coasts.

Keith's particular interest lies in Dry Docking. Starting with the construction of the Walvis Bay Syncrolift in 1973 and its management until 1991, he has, one way or another, had some involvement with most of the dry docking facilities in Africa south of the equator from Gabon in the west to the Seychelles in the east. More recently he has provided advice on dry docking projects in India. His involvement ranges from feasibility studies through design and construction to operations and maintenance. His coherent theory of Dry Docking allows significant improvements in the design of dry docks and in the practical techniques of constructing small systems. He was awarded the SA Institution of Civil Engineers Gold Medal for Construction for this work. He is also involved in ongoing research into the subject of Dry Docking.

He has trained in corrosion engineering and has designed numerous marine anti corrosion systems, both heavy-duty coatings for steelwork and cathodic protection systems for immersed structures. He has also trained in Environmental Impact Assessment. He has made a number of such studies for marine projects and is able to advise on environmentally compatible design and construction.

Amongst his more notable projects are the design and construction of breakwaters at Gansbaai, Yserfontein and Lamberts Bay. He has recently served as the Coastal Engineer on the Integrated Coastal Zone Management Framework study for Mauritius and made the preliminary design studies for an esplanade subject to cyclone action on the Vilanculos marginal in Mozambique. Recently the Barbados Government retained Keith to advise on the restoration of the oldest surviving shiplift in the world, built in 1893 in Bridgetown, Barbados. The design is unique and of enormous importance to industrial history.

Papers

Keith has published numerous technical papers both locally and internationally on subjects to do with coastal & harbour engineering, on dry docking, corrosion, dredging, on the administrative disaster of the South African fishing harbours and the use of fractal geometry to characterise coastlines.

Books

As a service to industry, Keith has published textbooks on the operation of dry docks, Dry Dock Manual at a technical level and Small Dry Dock Manual at a non-technical level and a comprehensive manual, Basic Coastal & Harbour Engineering that is up to date and covers the whole field of Coastal Engineering. He lectures on all these subjects.

Community

Keith is a member of the Council of the South African Institution of Civil Engineers, the Council of the South African Institute of Marine Engineers and Naval Architects and the Western Cape branch to the SAICE.

He is also a Trustee of the Hout Bay & Llandudno Heritage Association and acts as their consulting engineer on the restoration of the historic 1781 gun batteries in Hout Bay.

Although mixes using these cement displacers commonly result in higher chloride permeability, overall corrosion levels can be much lower.

Other issues discussed in this chapter are:

- Quality Assurance
- Condition Assessment & Preventative Maintenance
- Life Cycle Costing
- Life Cycle Assessment

3. Durability design

3.1. Probability based approach

Various methods of doing this are discussed. In particular that the limit state level should be set as the onset of steel corrosion.

Discussion on cement extenders does not give explicit design methods but does give information that shows that while the onset of the limit state in concretes with only OPC is in the order of 15 years, that when cements with either 34% or 70% blast-furnace slag extenders are used, the time to onset of the limit state is in excess of 120 years.

The issue of cover is not as propitious. The 10% probability of reaching the limit state with the usual cover of 60 mm for marine structures is only about 15 years. The time to limit state increases only slowly with extra cover and such increased cover increases the risk of tension cracking.

3.2. Performance based approach

This section discusses performance based issues as a basis for contract documents.

4. Additional strategies and protective measures

4.1. General

Over and above the precautions take in the design, construction of the structure and in the concrete mix design, further protective measures are recommended.

4.2. Stainless Steel

The use of stainless steel reinforcement in concrete structures has proved to be very effective in combatting corrosion. The high cost of stainless steel favours limiting their use to those rods that are subject to greatest risk of corrosion and this in turn invokes the issue of bi-metallic corrosion between the stainless steel and the mild steel. Experience, however indicates that this risk is negligible.

There are a large number of alloys of stainless steel and it is important to choose the correct alloy.

4.3. Non-metallic reinforcement

The use of fibre-reinforced polymer (FRP) composite as reinforcement is growing rapidly. The specific properties need to be checked but they can exceed those of steel even in prestressed concrete.

4.4. Concrete surface protection

It is practical to treat the surface of the concrete in order to protect the reinforcing steel. There are three main types of treatment:

- Organic coatings such as epoxies that may be thick or thin
- Treatments that fill the capillary pores
- Hydrophobic treatment that lines the surfaces of the pores

Other strategies involve cathodic protection and corrosion inhibitors. Notably absent from the discussion is mention of hot dip galvanizing of reinforcement.

Structural shape

The shape of structural elements does affect their susceptibility to corrosion of the reinforcement. Generally, the soffits of flat slabs are far less at risk than beams and columns.

Prefabricated elements

In general the contro of the fabrication of these elements if far better than that of insitu work with less risk of corrosion of the reinforcement.

5. Quality assurance

Quality assurance is essential in the construction of reinforced concrete structures in particular with respect to corrosion of the reinforcement.

In this regard quality assurance regarding the cover to the reinforcement is the single most important part of the QA system.

6. Condition assessment, preventative maintenance and repairs

This chapter reviews the main issues, particularly the matter of chloride ingress.

A discussion on patch repairs confirms that patches done earlier enough may be good enough to control further corrosion but delayed, they are not able to prevent the corrosion from spreading. Inadequate patching is likely to make matters worse.

Cathodic protection as an impressed current system either pre- or post- installed can be very effective but they, in turn, need to be maintained over long periods of time.

7. References

The report has an extensive reference section but no mention of the work being done by Prof. Mark Alexander and his group at UCT

APPENDIX C provides an in-depth discussion of the determination of concrete cover.

APPENDICES D to F describe commercial computer models to analyse the corrosion processes and the service life of structures.

APPENDIX F describes various testing procedure and instruments.

Conclusion

Overall, this report provides a good, up to date overview and understanding of the processes involved in the corrosion of concrete reinforcement and the control of this form of corrosion. In particular, it demonstrates the function of the concrete itself as the anti-corrosion control.

In general, it provides a good procedure for engineers concerned with controlling the corrosion of concrete reinforcement.

Coating quality control – concrete substrates

Coated concrete is commonly used as a building material and is arguably the most likely to experience coating failures. These failures greatly increase the potential for premature degradation of the substrate material and typically require a considerable expenditure of resources to repair.

In many cases, the lack of a comprehensive Quality Control Procedure is at the root of coating failures. As with other building materials, applying coatings to concrete requires specific measures to ensure coating performance and longevity.

Assuming the concrete surface is sound, that it is not compromised by contaminants such as dust, oil and grease, and that the moisture level in the concrete is suitable for painting, the following measures should be part of a quality control program for coating application.

Surface preparation

One of the first considerations in assuring coating quality control is the compatibility of the concrete's physical surface texture (also known as the anchor or surface "profile") with the coating to be applied. The recent ASTM standard D7682 *"Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty"* references both Method A (visual comparison) and Method B (quantifiable measurement) as means by which to determine concrete surface profile. Given the possibility for coating failure and both preparation and materials costs, it may be desirable to have a permanent record of this profile for reference.

One such test method that satisfies both the visual comparison and quantifiable measurement for surface profile utilizes a rapid cure, two-part putty. Through application and removal of the putty, a permanent relief mold of a surface sample is obtained. The relief mold may be visually compared to ICRI (International Concrete Repair Institute) CSP (concrete surface profile) coupons or measured with a specially-built micrometer at multiple areas on the mold in accordance with the testing method.

An alternate measurement solution is provided by specialized depth micrometer instruments. These have a flat base and a spring-loaded tip which drops into the valleys of the surface profile. The flat base rests on the highest peaks and each measurement is therefore the distance between the highest local peaks and the particular valley into which the tip has projected. Instruments of this type are

ideal for measuring up to 6 mm of profile height directly on the surface without the need for replica putty or the vagueness of comparators. They are ideal for measuring the surface profile of concrete that has been prepared by blasting, scarifying, grinding, acid etching and other preparatory methods.

Environmental considerations

Surface preparation and coating application should be performed under optimum environmental conditions to help prevent potential coating failure. A major factor affecting the long-term performance of coatings on concrete is the climatic conditions during pre-treatment and coating application. Handheld, electronic devices enable painting contractors, inspectors and owners to measure and record applicable environmental conditions.

The primary reason for measuring climatic conditions is to avoid rework and the premature failure of protective coatings. Recommendations and requirements are covered under various internationally recognized standards in addition to those specified by the coating manufacturer. The ability to log results is also valuable as documentation of these conditions before, during and after the coating process.

Coating thickness

The primary purpose for measuring coating thickness on concrete is to control coating costs while ensuring adequate coverage. Commercial contracts often require an independent inspection of the work upon completion.

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Masonry coatings are used for a multitude of purposes including cosmetic appearance, durability, abrasion resistance, as well as protection from elements such as moisture, salt, chemical and ultra-violet light. Common coatings for concrete include latex paints, acrylics, lacquers, urethanes, epoxies, polyureas, and polyester resins.

Traditionally, a destructive test method was used to determine coating thickness on masonry substrates such as concrete. Coatings used on concrete range from hard to soft, smooth to textured, and cover a wide thickness range. The surface of concrete can be quite rough, which can create significant variations in thickness measurements.

ASTM D6132 *"Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gauge"* details a non-destructive test method which eliminates the need to repair the coating after inspection, saving time for both the inspector and the contractor. Ultrasonic measurement testing equipment operates by sending an ultrasonic pulse into a coating using a probe (i.e. a transducer) with the assistance of a couplant applied to the surface.

Ultrasonic coating thickness gauges are also utilized within the scope of SSPC-PA 9 *"Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages".* The PA 9 method determines coating thickness by averaging a prescribed minimum number of acceptable (under the method) gauge readings within separate spot measurement areas of a coated surface.

Coating adhesion

Once the coating has been correctly applied to the required thickness, is it desirable to quantitatively measure the bond strength between the coating and concrete substrate. This testing method is detailed in ASTM D7234 *"Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers".* SSPC-PA 14 *"Application of Thick Film Polyurea and Polyurethane Coatings to Concrete and Steel Using Plural-Component Equipment"* provides comprehensive guidance concerning adhesion testing of polyurea coatings applied to concrete substrates.

Pull-off adhesion testing is a measure of the resistance of a coating to separation from a substrate when a perpendicular tensile force is applied. Portable pull-off adhesion testers measure the force required to pull a specified area of coating away from its substrate. This measured pull-off force provides a direct indication of the strength of tensile adhesion between the coating and the substrate. By eliminating sources of pull-off variation, such as unintended bond failures between the adhesive and poorly prepared dollies, adhesion test results become even more meaningful and predictable.

Can galvanized and black steel reinforcement be used together in concrete?

Because zinc is naturally protective to steel, galvanized reinforcement can be safely mixed with uncoated in concrete. However, if galvanized steel and black steel are to be connected in concrete, say for example between different mesh layers of an exposed panel or the upper section only of reinforcement in a pile foundation in the ground, the best option is to ensure that the point of connection between the two materials is well embedded and sufficiently deep such that there is no corrosion risk for either material, but especially so the steel.

If corrosion of the black steel were to initiate at the connection, the zinc on the adjacent bar will simply act to cathodically protect the black steel. Clearly, the protection afforded by the dissolution of the zinc will cause the zinc to slowly dissolve and this is, of course, not the preferred outcome. To an extent this could be seen as wasting the benefit obtained by using galvanized steel in the first instance. So, to be safe, minimise the connections between galvanized steel and black steel as far as possible but if this is necessary then keep the 3 point of connection deeply embedded in sound concrete where the risk of corrosion of the steel is minimal.

We wish to thank Prof. Stephen Yeomans, author of a number of books on the subject, for this contribution.

The major components of a pull-off adhesion tester are a pressure source, a pressure gauge and an actuator. During operation, the flat face of a loading fixture (dolly) is adhered to the coating to be evaluated. After allowing for the adhesive to cure, a connector from the actuator is attached to the dolly. By activating the pressure source, pressure is slowly increased on the loading fixture, until it pulls away from the substrate.

When testing on concrete, the pressure in the actuator typically exceeds the internal tensile strength of the concrete itself, at which point a cohesive failure occurs within the concrete. The maximum pressure indicator of the system's pressure gauge provides a direct reading of the pressure at which the pull-off occurred. With proper cutting around the dolly, the instrument can also be used to measure the tensile strength of uncoated concrete, as well as concrete repairs.

Coating continuity

To perform its intended function, a coating must be applied as a continuous film. Pinhole (holiday) detection is useful for locating pinholes, holidays, cracks, etc. which are not readily visible. Low-voltage pinhole detectors are commonly used to inspect coatings thinner than 500 µm applied to concrete and other conductive substrates.

A low-voltage pinhole test is performed by moving a moistened, electrified sponge over a non-conductive coating applied to a relatively conductive substrate such as metal or concrete. The instrument is 'grounded' or 'earthed' to the conductive substrate, typically by clamping onto an uncoated area.

The challenge when conducting low-voltage pinhole testing on concrete is to ensure the instrument is properly grounded. The ideal grounding location is exposed rebar or metal protruding from the concrete. An alternative is to drive a metal rod (or piece of rebar) into the ground nearby the concrete to at least the depth of the slab, relying on the earth to conduct the electric current between the rod and the slab.

Conclusion

As the use of concrete as a building material continues to grow, so too does the need to establish proper Quality Control measures when applying coatings. As outlined above, these measures ensure longevity of both the coating and the underlying structure and are a primary contributor to meeting cost and performance expectations.

We wish to thank David Beamish of Defelsko Corporation for this contribution.

From the KETTLE

Because corrosion control of steel by hot dip galvanizing plays such an extremely important role for specifiers and end-users in their specification choice, it was proposed that we highlight and demystify a number of surface conditions over a series of editions that bear very little influence of the coatings durability seen both during the initial inspection and also after years of being exposed to a particular environment. See surface condition F13 and F14.

Legend

#1 As the life of a zinc coating is proportional to its thickness, a thicker coating will proportionally outlast a thinner one, however, a thicker coating can be more prone to mechanical damage, when handled inappropriately.

#2 All passivation products including sodium di-chromate will be excluded by the galvanizer when he has received written instructions that the hot dip galvanized steel is to be painted.

#3 While double dipping is occasionally seen to be necessary due to a limited bath size, the galvanizer must inform the customer that this practice can increase the propensity for distortion, before he commences with the work.

#4 While the galvanizer can lower the zinc temperature and shorten the immersion time (not practical in terms of the first photographic example) to limit coating pickup, however, due to increased costs to himself, he is not obliged to do this and if necessary will recover the cost from the purchaser. Insufficient vent, fill and drain holes will lengthen immersion times.

Hdg Hot dip galvanizing **A** Accept **R** Reject **N** Negotiate **C** Clean **REP** Repair **SS** Significant surface.

F13

DESCRIPTION:

Ungalvanized surfaces caused by rolled in millscale or sand.

CAUSE:

Trapped moulding sand on cast iron or rolled in mill scale on the steel surface is generally caused by the process used to form or roll the product.

A localised ungalvanized area in an otherwise continuous coating can occur if sand from the casting mould or mill scale formed during rolling is not removed by acid pickling or abrasive blasting.

Photo 5 shows the appearance of rolled in millscale before hot dip galvanizing.

EFFECT / REMEDY:

Ungalvanized areas may occur in a linear pattern on angles, channels or beams or locally due to ingrained and trapped casting sand on cast iron components.

Unless rolled in mill scale and trapped casting sand has been thoroughly removed by abrasive blasting prior to acid pickling, bare spots will occur after hot dip galvanizing. Depending on the extent of such uncoated areas, coating repairs are required. Where local uncoated areas are excessive >10cm² or >0.5% of the components total surface area the coating may have to be stripped off and regalvanized. Alternatively depending on the cause, size and urgency of the component, appropriate repair maybe negotiated with all parties.

ACCEPTABLE TO SANS 121:

Refer to customer.

A and REP or R and strip off zinc coating, abrasive blast and re-galvanize.

ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:

Refer to customer.

R (D & A) and strip off zinc coating, abrasive blast and re-galvanize.

continued on page 26...

1


2


3


4


5


6

F14

DESCRIPTION:
Poor quality cast iron ornamental security gate spikes.

CAUSE:

Security gate spikes are usually manufactured from cast iron having significantly different quality standards. Poor quality cast iron is difficult to successfully hot dip galvanize without uncoated areas and residual material slag. In addition such cast iron components are brittle and when welded to a steel gate often break off during the galvanizing process (photos 7 and 8) and general handling. Porous welding to gate component will also affect the galvanized quality.

EFFECT / REMEDY:

Poor quality cast iron spikes often have sand inclusions and require abrasive blasting prior to flash pickling and hot dip galvanizing on their own (photos 8 and 9).

In this way the quality of the cast iron components does not compromise the quality of the hot dip galvanizing of the larger gate and breakages of the spikes are avoided.

ACCEPTABLE TO SANS 121:

Refer to customer.

A

ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:

Refer to customer.

A

Cast steel spikes are available (see photos 10, 11 and 12) which are far more resistant to mechanical handling, can be welded to the gate prior to processing and result in quality hot dip galvanized coatings of the whole assembly.


7


8


9


10


11


12

Hot dip galvanized and duplex coating repair procedure

In terms of SANS 121 (ISO 1461) a galvanizer may repair a coating by either zinc metal spraying or zinc rich paint or epoxy. The latter method must conform to certain requirements in the specification. Repair will only be necessary if bare spots are present, usually caused by air entrapment or if mechanical handling damage has occurred.

Should repairs be considered necessary on site due to site modifications or mechanical damage the ruling from the specification on maximum repair area applies. The individual repair area is set at no greater than 10cm² but less than 0.5% of the components total area. As a practical guideline all repairs should be limited to areas that have been cut or welded and other damaged areas approximately less than that covered by a R5 coin.

Due to the remoteness of most sites, however, and the unavailability of metal spraying equipment, repairs by zinc rich epoxy or zinc rich paint, have to date generally been more popular.

Thermal sprayed coatings

Method

The area to be repaired is lightly blasted using a small blasting nozzle so as not to damage the surrounding coating. A thermal (metal) sprayed coating is then applied to the abrasively blasted surface to a thickness of at least 100μm unless the purchaser advises the galvanizer otherwise, for example when a duplex coating is to be applied the coating thickness at the repaired area is to be the same as the surrounding galvanizing. The repaired area is then wire brushed, (preferably stainless steel brush) to remove loosely adhering over sprayed zinc. Wire brushing provides the added benefit of sealing pores that may be present in the sprayed coating.

Zinc rich epoxy or zinc rich paint

Method

This repair method should be limited to small coating defects and areas that have been cut or welded on site.

The defective area should preferably be abraded with abrasive paper (roughness 80 grit) or alternatively thoroughly cleaned preferably using a stainless steel brush. All dust and debris must be completely removed. In the event of moisture being present, all surfaces are to be properly dried.

A zinc rich paint or epoxy containing not less than 90% of zinc in the dry film, should be applied to a thickness of at least 100μm unless the purchaser advises the galvanizer otherwise, for example when a duplex coating is to be applied the coating thickness at the repaired area is to be the same as the surrounding galvanizing. The paint coating should overlap the surrounding zinc by about 5mm.

The preferred product is a two-component zinc rich epoxy to SABS 926. Up until recently this product was only available in large containers. Due to the large quantities involved and short pot life when mixed, the system proved to be expensive and wasteful.

Two products are now available in a squish pack form called "Galvpatch" and "Zincfix". The packs are for convenience available in a 100gm size. The 100gm quantity will coat an area of about 0.25m², to a DFT (Dry film thickness) of 100 to 150μm in a single application. The content is easily mixed in accurate proportions. Once mixed the product will heat up after 10 minutes and must be used within 25 minutes of mixing.

Do not attempt to use the products after the pot-life has been exceeded. The pot-life will be slightly shorter at higher temperatures and longer at lower temperatures.

The squish packs can be ordered from several sources including most reputable hot dip galvanizers in South Africa.

Single pack zinc rich paints are good materials and can easily be applied, they, however, require several coats to achieve a reasonable repair. Multiple coats will also necessitate longer drying times between coats.

A further added benefit of "Galvpatch" and "Zinc Fix" is the products' high zinc content contained within a solvent free epoxy.

Making use of zinc spray paints for coating repairs should be curtailed due to two reasons:

1. The sprayed coating will require multiple applications to achieve the required DFT, which on site is impractical.
2. The silver spray colour while replicating a freshly hot dip galvanized finish, will be irritatingly noticeable once the zinc carbonate film has naturally formed.

The only time a zinc spray coating can be considered is when it is required for immediate colour match of the freshly hot dip galvanized finish. It is then to be sprayed as a mist spray (very light) over the slightly darker appropriately applied squish pack or single pack repair kits, mentioned above.

Repair of damaged or site altered components with a duplex coating

In the event that a duplex system has been applied and subsequent coating damage has occurred, the damaged coating is to be thoroughly abraded to create a rough profile before over coating with the appropriate paint. All paint coating repairs are to be carried out in accordance with the paint manufacturer's specification.

In the event that the hot dip galvanized coating beneath the paint coat has been cut or damaged, one of the above coating repair methods must be enforced before any top coats (in accordance with the duplex specification) is applied.

Comment – Chairman of the Western Cape

I had a brief look at my first Chairman's report just over 2 years ago when Corrosion Exclusively was launched. I think everyone will agree that Terry and his team have done an exceptional job in the quality and relevance of the magazine. It has proved to be a fantastic mouth piece for the industry and I am confident that it will continue to grow from strength to strength.

Since my last report we have had a very interesting talk, our first round robin discussion and our AGM. The talk by Darelle van Rensburg - "Corrosion Rates around the country" was very well attended and informative and we look forward to the final report once her thesis has been published.

The July presentation in conjunction with OCCA saw Pyrocote, Jotun and Stoncor each presenting a short talk on various aspects of Intumescent Coatings. Over 70 people attended and by all accounts it was a very interesting evening. The talk was preceded by a presentation by Dr Ivor Blumenthal on the development of the Corrosion industry into a professional body. I think this is the future for the industry and everyone in attendance is very excited about this direction.

At the AGM, Sieg Le Cock and Gilbert Theron joined the incumbents on the committee. Welcome Sieg & Gilbert! I would like to thank the whole team for a fantastic effort in making the W Cape such a thriving region. The fantastic turnouts are testament to this.

Our Mini Expo in September is taking place at Rand Air and we encourage exhibitors and interested parties to get hold of us. Space is filling up fast. With a month to go we have 22 exhibitors and a lot of further interest. A number of companies will be demonstrating their instruments and equipment so I encourage everyone who is involved in the industry to attend. Please feel free to spread the word and invite others in the industry who might be interested.

In October we will have a very pertinent and important presentation by Armand Hoffmann from Coetzee Safety Consultants on Health and safety in the work place based on latest legislation and the legal labiality of the asset owner. It will have a number of videos so it promises to be both interesting and informative.

In November we look forward to another successful and fun Annual Gala Dinner. With world renowned comedian Barry Hilton as our entertainment it will be a not to be missed event. Book your spot now!

Hopefully see you at Kelvin Grove for one of our functions soon! If you have not attended before, please feel free to join and if you have, bring a friend to the next gathering.

Yours in Corrosion

Graham Duk, on behalf of Tammy Barendilla, Leonie du Rand, Thinus Grobbelaar, John Houston, Sieg le Cock, Indrin Naidoo, Terry Smith, Gilbert Theron, Flippie van Dyk, Pieter van Riet

Comment – Chairman of KwaZulu Natal

Three months have passed by in a blur of personal and work activities and I'm sure this fact is true for all of us…

In this time, we only managed to host one technical evening – the presentation by Ceramic Polymers GmbH, of Germany, on the introduction of ceramic based polymers into the South African market.

Unfortunately, due to the pressures of our work and personal lives, neither Karyn nor I have found much opportunity to organise or host other technical evenings. This is sad considering that at one time the KZN technical evenings were considered "legendary". We need your help! Please consider volunteering some time and contact either myself on *mark.terblanche@primeinspection.co.za* or Karyn Albrecht on *karyn@avaxprojects.co.za* if you have any suggestions, comments or can organise/host a technical evening – this will always be welcomed and you will get our full support.

Regards, Mark Terblanche and Karyn Albrecht.

Due to the economic pressures that most industries in South Africa are currently facing, CorrISA and its members are no different, we have had to cut back on strategic staff at the Institute.

Both the Manager - Lynette van Zyl and Receptionist Thobi Thubane sadly have been made redundant and will not be replaced in the near future. We wish you both well in the future.

Liz Rathgens (accounts@corrisa.org.za) as the current Financial Administrator will be the responsible officer at the CORE. Linda Hinrichsen (courses@corrisa.org.za) will still be the Course Administrator and Ratanang Moraladi (admin@corrisa.org.za) will be looking after memberships, sub committees, media updates and general secretarial administration.

CorrISA Johannesburg and Western Cape Region host international visitors from NACE

The Western Cape section were honoured to host Pam Nicoletti, the Director for education from NACE in Houston and Gasem Fallatah, who is head of NACE in the Middle East and Africa.

Other than showing them the sights of Cape Town, we also discussed a strategic partnership and the future for NACE in Africa. The discussion was positively continued when Pam and Gasem met with Executive members of CorrISA on their Johannesburg leg of their journey. They were also introduced to the delegates on the CIP1 course which was being run in Cape Town at the time.

TECHNICAL EVENTS: Cape Town

NACE CIP 1 TRAINING COURSE: Johannesburg

NACE CIP 1 TRAINING COURSE: Cape Town

The RUST Spot...

In conversation with Tim Henning

Briefly explain your background and how you came to be involved in corrosion?

Quite by accident, I was with a friend of mine at the Wanderers Club, Johannesburg, he mentioned that the company he was working for was looking to employ Trainee Laboratory Personnel, was I interested. Being technically inclined I said yes! The company was Herbert Evans Paints, the year mid 1968 and nearly 50 years later I am still involved in coatings and corrosion.

What year did you join the Corrosion Institute or why if you were not a member are you in the photo below?

I have never been a member of the SA Corrosion Institute but have been a member of OCCA SA for over 40 years. The photo is of the OCCA KZN committee in around 1978 – 1979. In those years the Corrosion Institute did not have a branch in KZN, any technical meetings at that time was organised and held through the OCCA KZN branch.

What was the state of the industry then and what, if any, role did you play within the Institute?

The corrosion institute was very much in its infancy in the early 1970s, as noted above I am not a member of the institute. My role over the years has been through OCCA, SA.

Talk about your years involved in corrosion and what changes you've seen over that time?

I was fortunate that I was employed in the paint manufacturing industry at the time when Research & Devolvement (R& D) into products to protect steelwork against corrosion in South Africa was at its highest point. I had now joined Dulux Paints who were in the early 1970s the leading paint manufactures in R&D for products in the corrosion protection industry. As there were a number of major projects being constructed at that time we at Dulux were at the coal face of these projects. To meet the demands a separate division was formed which was headed by the late Tom Edwards. It was a really exciting period with a high demand for technical knowledge required and the drawing up of specifications for a variety of structural components and projects.

It was from those years that I personally developed my knowledge and experience in the ever changing field of corrosion and corrosion engineering. It also gave me the confidence to step out of the corporate world and become an independent corrosion consultant and be retained by a number of major corporations in their engineering projects.

There are always changes in this type of industry particularly in technology. Being from a coatings background there have been significant developments in the technology of resins specifically the Epoxies, Polyurethanes and Acrylics, due mainly to legislation to reduce VOC levels. Hot dip galvanizing has also made huge advances as a coating for corrosion prevention. There have been material changes to metals for corrosion resistance in the Stainless Steels, even the carbon mild steels have had metallurgical changes. Fibre Glass composites are now playing a greater role in the corrosion industry. It is why in SA we need as a priority to train , develop and expand our technical skills requirements to meet the needs and demands of the corrosion industry.

What successes did you enjoy during your time in corrosion and what role do you play now?

The role I am involved in the corrosion engineering industry is one of a Consultant, Project Manager and 3rd Party Surveillance. Over the last 40 odd years there have been a number of successes, primarily those with major project developments, such as Iscor

Among those at the Natal Section AGM were, from left, Mr W. Wieczorrek (the guest speaker of Bayer AG West Germany), David Williams-Wynn (chairman), Martin van Rensburg, Ken Piggott (vice-chairman), Tim Henning, Laurie Saunders, John Cush (symposium chairman) and Roley Eglington (the new SA vice-president).

This photo was taken from CorrISA's archives and reminisced in an article on the early history of CorrISA in the inaugral edition of CE.

(new ArcelorMittal) Newcastle, the first phase Sasol Plant in Secunda; Hendrina Power Station 2003 Shut-Down; Richards Bay from the Coal Terminal, the Harbour, Richards Bay Minerals, the two Alusaf Plants, Bayside and Hillside (under new ownership) Mondi Paper; Felixton Sugar Mill.

There are many other smaller projects and developments from the two Oil Refineries, Sapref and Engen, Pulp & Paper and general industry. However, where I suppose I gained my greatest success and satisfaction was the 5 years at Richards Bay Minerals where I worked with their Special Projects Team. Richards Bay Coal Terminal, starting and implementing their annual corrosion division management audits was also a challenging and rewarding s project. Another challenge was Project Managing the upgrading of a prominent Durban Hotel and Resort, Durban Spa. This challenge was different in that I had to pull together 14 contractors from building, to shop front installations. We had limited time to complete the upgrading and turn the whole front floor entrance to the hotel, including the change rooms to the main Spa area, from one that over 30 years old into a new fresh and up-dated image. The project has now resulted in the hotel being up-graded to Gold Status and Four Stars.

If you could go back, what things would you do differently?

On reflection to this question, nothing really, it been an exciting and challenging nearly 50 years and in that time I have worked and meet with some of South Africa top chemists and engineers (testimony of the photo of the OCCA committee) The only thing I would do differently if I could go back is to get and complete a degree or diploma in engineering or corrosion science.

What advice do you have for the corrosion related industry going forward?

In SA we have a number of institutes/ associations that are related to the corrosion industry, they being SA Corrosion Institute, OCCA, SA Galvanizing Association, with as a close cousin the S A Institute of Steel Construction. In the every changing face of South Africa today, in my opinion the SA Corr Institue,OCCA and the HDGSA should join forces and form a strong professional body. This body must as a priority to its constitution be the leader in the industry for basic skills and education training and certification. In addition to this the body must work far more closely with the Universities and Technical Colleges, so that the overall industries become fully competent in the field of corrosion science and engineering. This question is a subject matter on its own, but I believe such a combined body has the ability to become a real force in the corrosion / coatings industry, but we need the qualified personnal and the professional association/ body to drive it.

Something about yourself: your family, sports, hobbies, pets, travel, passions...

Happily married, with children and grandchildren, still being here in SA. My wife and I have started playing bowls on a regular basis and are thoroughly enjoying it. I have a great passion for reading, particularly engineering and science news, but also history and the politics of this amazing country.

OBITUARY

COLIN STEPHEN BUNCE

1950 – 2017

Colin Stephen Bunce passed away on Tuesday the 1st August 2017 at his home in Durban. Colin was born 09 September 1950 in Newport Gwent South Wales

He was passionate about his work and was always willing to assist with his wealth of knowledge to get the job done right. He was in the Corrosion Industry for over 40 years, starting at the bottom as a blaster and working his way up to supervisor. Colin and his family moved to South Africa in March 1985 where he started working for Durban Marine Contractors (DMC). He then went on to work for Dorbyl Eastern Cape and then transitioned from contracting to the inspection side of the industry with TUV Rheinland International.

He started his own 3rd Party Inspection company, Blast Cleaning Specialized Coatings, working closely with CCCI in 1994 to 2004. He then became CEO of Isinyithi Corrosion Engineering (ICE) until the time of his death.

He was an avid snooker and boxing fan (we are sure he will be watching the Mayweather vs Mcgregor fight from above).

In his final years, he loved spending time with his family at the dam or at the harbour in his boat and looking at the ships.

He is survived by his wife Joy and his two sons Garry and Lee who are carrying on in his footsteps with ICE.