Vol. 7 Issue 1 I 2021

Corrosion Exclusively

INSIDE:

- Protecting concrete bridges using zinc anodes
- Benefits of galvanizing cruise into the Port of Brisbane
- Monster crocodile
- Zinc primers: an overview
- Zinc magic in corrosion protection

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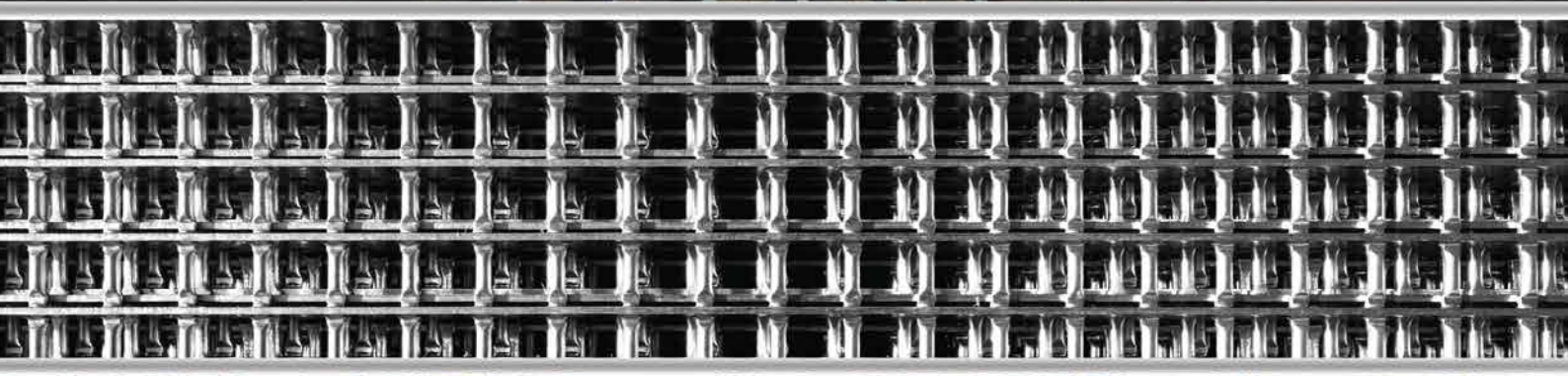

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President's Comment

We are now deep into 2021 and COVID is still tenaciously continuing with its deleterious effect on our lives and our livelihood. The good news is that the number of new infections seemed to have reach a peak at the end of last year and has been trending downwards ever since. It's been a long and difficult 12 months wherein all of us have been affected in one way or the other. The second wave came with a vengeance and I am sure that very few of us were unscathed as it continued. My condolences to those that have lost loved ones, colleagues and friends.

However, despite the above there seems to be a new change in the mood in the industry and I hear from many people that are eager to rebuild and seize opportunities that are surfacing. There are indeed opportunities coming to the fore but please be careful out there as along with the genuine opportunities are a plethora of equally enticing scams. My emails are regularly filled with scam tenders inviting me to tender on the supply of Army boots or sanitizing dispenses and a whole range of products that I don't even deal with. So double check when asked to tender, names of real people are used and even seemingly the correct office telephone number but things are amiss. I have yet to find a government tender that requires that you deliver products within less than a week from you being contacted with the "good" news that you have won the tender for 50 000 class 2 face masks or 50 specialised pumps etc. Do your own investigation. Phone the place that supposedly sent out the tender and verify that they have indeed issued the tender. If you don't you may find yourself delivering your items to a government premises and some fictitious paperwork provided to you and when you submit it for payment there are no records of the tender and by the time you get back to the point of delivery the scammers and your items are long gone.
On the direct corrosion side of things, the progress of corrosion has of course despite our best efforts not slowed and the fight continues. During the lock down period, as the pandemic necessitated regulations were enforced seemingly non-essential tasks were in many instances left undone in the interests of lowering the wave. And from what I have recently seen in many cases dealing with anti-corrosion issues fell into this 'leave it for later" category and this is likely to come back with a disturbing vigour and I suspect that a surge in the fight against corrosion is looming.

With Covid in abeyance things are likely to start improving but please take care as there is sporadic whispering of a possible third and subsequent wave arriving to impede our progress. Continue to wear masks, wash and sanitize regularly and to maintain the social distancing. The world as we knew it will never be the same.

Greg Combrink, President – Corrosion Institute of Southern Africa

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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The Corrosion Institute of Southern Africa
38 Allan Road, Glen Austin, Midrand,
South Africa
PO Box 5656 Halfway House 1685
International Tel: +27 (0)10 224 0761
Local Tel: 0861 267772
www.corrosioninstitute.org.za

Executive Director
Petra Mitchell
Email: director@corrisa.org.za

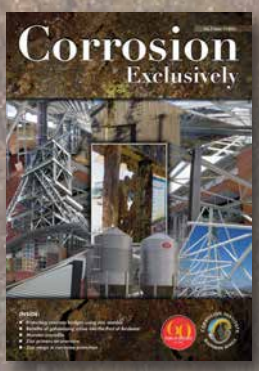
Editor, Producer and Advert Sales
Terry Smith
Tel: 021 797 4735
Cell: 082 893 3911
Email: editor@corrisa.org.za

Chairman Cape Region
Graham Duk
Cell: 021 683 2100
Email: vp1@corrisa.org.za

Chairperson KZN
Karyn Albrecht
Cell: 083 666 6638
Email: kwazulu-natal@corrisa.org.za

Design and Layout
Sandra Addinall
Tel: 011 868 3408
Email: cbtdesign@adcot.co.za

Reproduction and Printing
Camera Press
Tel: 011 334 3815
Email: cpquotes@camerapress.co.za



Cover: A kaleidoscope of metallic zinc and duplex coatings surrounding a dreaded corroded piece of steel

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Editorial Comment

I think that most in South Africa were hoping to see the back of this extremely difficult period caused by the pandemic but sadly until all are vaccinated, which may only be completed by the year end, we all still need to be cautious.

Our industry serves those who have corrosion related issues, mostly associated with carbon steel but sadly due to politics and possible greed the availability of this much used material is now in short supply. Our sincere condolences go out to management and staff of Saldanha Steel who have been in business for 22 years and now no longer in existance. As a result of this at least two other extremely important sources of continuous metallic coated sheeting companies on the coast have had to source their raw materials elsewhere possibly at higher prices and if this proves uncompetitive then they too may sadly follow the Sandanha Steel route.

In this edition we feature metallic zinc as a cost effective corrosion control coating when used in hot dip galvanizing, zinc rich paints, zinc thermal spraying, etc. Here are the articles:

- Protecting concrete bridges using external zinc anodes.
- Benefits of galvanizing cruise into the Port of Brisbane.
- Monster crocodile.
- Zinc primers an overview.
- Zinc magic in corrosion protection.

From the KETTLE, a regular contribution on hot dip galvanizing we discuss surface conditions F32 (Inappropriately small and/or incorrectly positioned vent holes can lead to reduced coating quality) and F33 (insufficient and inappropriate vent, fill and drainage holes).

We include a comment from Executive Director Petra Mitchell, who now manages the Corrosion Institute of Southern Africa.

Graham Duk the Western Cape chairman and Vice President of CorrISA gives an account of the Cape Region and the Chairman and Vice Chairman Karyn Albrecht and Marco Ashburner, respectively the KZN activities.

Under Education we include three recent NACE educational course's CIP 1 and CIP 2 as well as CP Tester that took place late November and mid-February this year respectively.

The "RUST Spot" features a long standing supporter and member of this industry Charles Dominion who has been involved in the development of abrasives for about 40 odd years.

We again wish to sincerely thank all our advertisers who under extremely trying financial circumstances continue to support the publication. It is again through the support of people and companies like yourselves that this publication will eventually be known as the "must read" magazine amongst all Southern African specifiers who require assistance when drawing up corrosion control specifications on behalf of their clients.

We also again wish to thank our amazing contributors, who painstakingly offer us technical articles of extreme value.

Terry Smith

Protecting Reinforced Concrete Structures with External Zinc Anodes

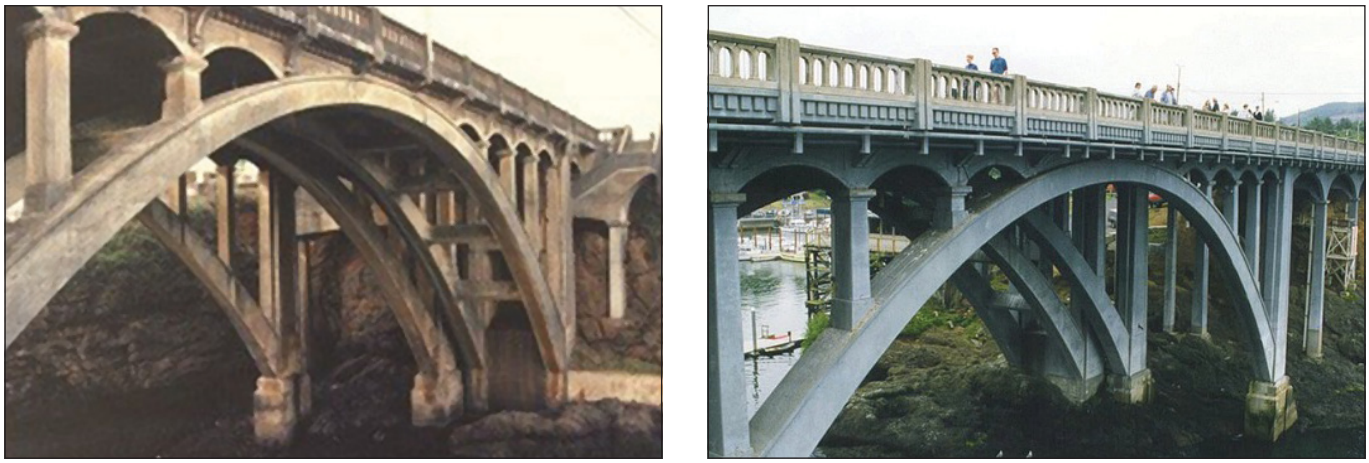
By Martin Gagné and Chadwick Martin

Corrosion of steel rebar is a significant cause of concrete degradation. The build-up of corrosion products on the rebar surface exerts pressure on the concrete, which leads to cracking and spalling of the concrete cover. The decrease in pH of a concrete structure with time due to carbonation increases the susceptibility of the rebar to corrosion.

Exposure to chlorides, through atmospheric deposition near seacoasts or through the use of road deicing salts during winter maintenance periods, will also accelerate deterioration of reinforced concrete structures. If left unchecked, rebar corrosion results in expensive repairs, decreased load carrying capacity, and premature structure replacements.

Steel may be protected against corrosion by connecting it to a zinc anode. When two different metals are in electrical contact, and bridged by an electrolyte, current flows from the anodic or base metal to the cathodic or more noble metal. In the case of iron (steel) and zinc, the base zinc anode protects the more noble iron. This is the basis of cathodic protection (CP).[1]

Impressed current CP (ICCP) systems consist of anodes that are connected to a power source that provides a continuous direct current. A control system is needed to provide enough current for the ICCP system to protect the target structure. CP transformer-rectifier units automatically adjust the operating voltage to maintain the optimum current output. For large complex target structures, such as bridges, the ICCP systems are often designed with multiple independent zones.[2]



Depoe Bay Bridge (above left) before installation and (above right) after installation of thermal sprayed zinc anodes.

The Oregon Department of Transportation (ODOT) selected thermal sprayed zinc coatings for use as anodes in ICCP systems on the historic Cape Creek, Yaquina Bay, and Depoe Bay bridges.[3] These three bridges are magnificent arch bridges on U.S. Route 101 designed in the Art Moderne style and listed in the National Register of Historic Places. The decision to repair these older bridges with a zinc anode-based ICCP system involved issues of public finance and safety, but also historical significance. The sprayed zinc anodes complement the historic structures, all while protecting the rebar by reducing the rate of corrosion, regenerating an alkaline environment around the rebar, and moving chloride ions away from the rebar.

Thermal sprayed zinc anodes

Thermal sprayed zinc anodes are well established as a component of ICCP systems for the corrosion protection of reinforced concrete structures.[4] The arc spray process, which propels molten zinc metal droplets onto the concrete surface,[5] was selected by ODOT since it could be easily applied to the complex shapes found on the three bridges. Zinc anodes minimize the dead load added to the structure, and the gray colour of zinc also looks very much like concrete, which was an important consideration for the rehabilitation of the historic bridges. Also, the low electrical resistivity of zinc allows uniform distribution of the CP current.[6]

The zinc anode is produced by impacting semi-solid droplets of zinc on a roughened concrete surface. This produces a metallic zinc layer with micro-pores and oxide coatings on the individually solidified particles. Coating thickness is dependent on the time of spray, and the anodes were a minimum 500µm (20 mils) thick on the three bridges.[7] Porosity typically makes up 5 to 7% of the coating volume. The overall coating has characteristics like solid metallic zinc.

ODOT practice for installation of thermal sprayed zinc anodes includes initial abrasive blasting of the entire surface in the work area on the bridge, followed by any needed repair of the concrete and the installation of the anode terminal plates. Then the concrete surface receiving the zinc anodes is grit blasted before thermally spraying the zinc anodes onto the concrete surface.[8]

The ICCP zinc anode zones are each ~300 to 500m^2 in size. Each zone has a connection to the reinforcing steel (cathode) and the thermal sprayed zinc (anode). The cathode connections are placed near the center of the zone and spaced ~3m apart. For redundancy, at least two anode connection

terminal plates are installed for each zone. At this location, the ICCP system positive wire terminates and the electric current is distributed to the zinc anode. The ICCP systems were operated by ODOT with a target current density (CD) of ~2.2 mA/m^2, which was found to adequately protect the steel reinforcement over a wide range of conditions.

The sound or rehabilitated concrete surface receiving the zinc anodes is blasted using a nonmetallic grit to provide an ICRI CSP 4 surface profile. It was found that abrasive blasting with a hard and dense grit material using a lower air pressure provided the best adhesion. However, it was important not to expose too much of the aggregate phase.[9]

The adhesion of the zinc anode to the concrete surface is mainly governed by the mechanical interaction of molten zinc droplets with the surface. The depth profile, as measured by the root mean square roughness, is the main parameter that can be related to the bond strength of the thermal sprayed zinc anode.[10] The adhesion of thermal sprayed zinc on concrete does not appear to be adversely influenced by severe freeze-thaw cycling.[11]

Cape Creek Bridge

The first ODOT project to use thermal sprayed zinc anodes for ICCP was the Cape Creek bridge. The zones were identified and selected based on architectural features, to have similar current requirements. In total, the sprayed surface area was 9 500m^2, with a coating thickness of 500µm. It was initially required to have the concrete surface at 21°C or warmer to keep it dry, and then supplemental surface heating applied immediately prior to zinc application to bring the concrete surface temperature to ~120°C.[12] ODOT has since shown that preheating is of no practical value unless the concrete is wet.[13] The bridge rehabilitation took 21 months and was completed in December 1991. The ICCP system has operated since January 1992.

Yaquina Bay Bridge

The Yaquina Bay bridge has the largest application of thermal sprayed zinc anode surface area of the three bridges discussed here. Between August 1992 and February 1994 (19 months), the arch spans were rehabilitated and the ICCP system was installed. This phase involved the thermal spraying of over 18 000m^2 of zinc anode. After the arches, it took 10 months to remediate the concrete and install the thermal spray zinc anodes on the south approach spans between September 1996 and June 1997. In this phase, an additional 6 000m^2 of zinc anodes were sprayed on the bridge.

Uneven consumption of the zinc anodes was observed on some areas of the Yaquina Bay bridge arches and southern spans. Investigations revealed that the rectifier voltage and currents were up to 10 times higher than the set points. The cause was due to the excessive current output from faulty rectifier controllers, and possibly from the application of humectants being tested in these areas to improve the electrical characteristics of the anodes.[14] Anode geometry, interference from other electrical systems in the area, and different local environmental conditions, such as time of wetness, may also contribute to uneven CD.[14]

Depoe Bay Bridge

The installation of the ICCP system on the Depoe Bay bridge *(Figure 1)* took 32 months from December 1993 to August 1996 and involved the thermal spraying of 5 900m^2 of zinc anodes. Of the three bridges, the Depoe Bay bridge has the smallest anode area; however, significant concrete repair was required. The bridge is also located in a sensitive area that includes a marina and the Depoe Bay Wayside Ocean state park. It was important that the concrete remediation and zinc thermal spray work was performed with minimal social or environmental impact.

Economics

The projects can be broken down into five broad components: mobilization and traffic, bridge rehabilitation, concrete preparation and repair, enclosure, and cathodic protection.[15] The largest cost component of the rehabilitation costs for the three bridges was the enclosure for protecting workers on site from the weather and for capturing any possible emissions. The enclosure also provides climate control for the thermal spray application, including adequately low humidity, surface temperature high enough to ensure dry concrete surfaces, ambient temperature, and minimal dust escaping.

The enclosure cost was influenced by operating in sensitive areas, and the high level of protection chosen by ODOT. The enclosure costs on the Yaquina Bay and Depoe Bay bridges were double the cost of the Cape Creek bridge because significantly more concrete repair work was needed and more of the bridge span is over open water. The average ICCP system, including anode installation, was 27% of the total cost of the bridge rehabilitation. The anode installation itself was only 14% of the total cost. By using the zinc-based ICCP system, ODOT saved the three bridges at a fraction of the replacement costs. The rehabilitation of the three bridges cost ~35% of the estimated replacement costs for new bridges.[7]

Monitoring costs for the Cape Creek Bridge ICCP system have been $1 200 per year for site visits and data acquisition. The power requirements to operate the ICCP systems are small. For example, the ICCP system of the Cape Creek Bridge requires ~15 000kWh per year (which is equivalent to a cost of $700 per year). These costs are very small compared to overall bridge maintenance costs.[15]

The zinc anode-based ICCP systems have been working well to protect the iconic reinforced concrete bridges, meeting the predicted anode life. Based on this performance, ODOT awarded a new contract in 2018 to replace the oldest anode installation and reinstall a new zinc anode-based ICCP system on the Cape Creek bridge, 27 years after the initial installation.

Conclusions

ODOT has successfully extended the lives of three iconic bridges by using thermal sprayed zinc coatings for use as anodes in

ABOUT THE AUTHORS

MARTIN GAGNÉ is principal at ZELIXIR, Inc., Toronto, Ontario, Canada. He has 29 years of research and development experience in zinc coatings, zinc castings, and zinc energy products. Gagné earned an M. Eng. in metallurgical engineering from McMaster University (Hamilton, Ontario, Canada). He has been a member of NACE International since 2017.

CHADWICK MARTIN is manager at Great Western Co. JV, Coburg, Oregon, USA, email: Cmartin@greatwesternco.net.

ICCP systems on the historic Cape Creek Bridge, the Yaquina Bay Bridge, and the Depoe Bay Bridge. The arc sprayed zinc anodes were easily applied to the complex shapes found on the bridges. Zinc anodes minimize the dead load added to the structure, and the gray colour of zinc was an important consideration for the rehabilitation of the historic bridges. Also, the low electrical resistivity of zinc allows uniform distribution of the CP current.

The 25-plus-year experience at ODOT shows that the service life of reinforced concrete structures can be economically extended by using metallic zinc anodes to protect the steel reinforcement from further corrosion.

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The Benefits of Galvanizing Cruise into the Port of Brisbane

The new $177 million Brisbane International Cruise Terminal has been designed to treat passengers to a world-class experience. Located at the mouth of the Brisbane River with access to deep water, the Cruise Terminal is equipped to handle a range of ships, including the largest cruise ships in the world.

Over 180 cruise ships had been scheduled to arrive during the 2020 - 2021 season prior to the outbreak of the COVID-19 pandemic. While COVID-19 is likely to have a sustained impact on tourism globally, the Cruise Terminal is expected to become a major gateway to south-east Queensland long-term, and a vital pillar of the tourism industry in Brisbane and throughout the sunshine state.

The Cruise Terminal will also deliver a major, long-term economic boost to the region. Within 20 years, it is likely to triple Brisbane's cruise industry to: support 3 750 jobs, bring over 760 000 visitors to the region annually, and contribute $1.3 billion in net expenditure to Brisbane's economy.

The terminal building itself occupies approximately 9 300m^2 , set over two levels, and is connected to a 200m long wharf. The elegantly designed structure features a covered elevated walkway from the passenger drop off area into a large span covered plaza, which then continues into the main entry, embankment hall, and café. Passengers access level one via travellators to immigration, and then make their way onto the elevated walkway, and through to the cruise ships.

The Cruise Terminal also encompasses a 900-space car park, fitted with solar panels that will generate approximately 1 300MW of power each year – the equivalent of powering approximately 160 homes. It is the Port of Brisbane's largest solar installation to date.

Transitioning from concrete to steel

Initially, the design of the elevated walkway called for the use of two large steel box beams on concrete piers with multiple precast concrete slabs fitted on top to form the walkway base. Steel roof portals were then to be fixed on top of the pre-cast concrete. The walkway consisted of twelve individual spans measuring 5.8m wide x 4m high and up to 32m long per span. This design would have meant working at height over water for the duration build.

Hindmarsh (the head contractor on the project) was keen to re-design the walkway to eliminate working at height over water during the installation of the elevated walkway trusses, and to reduce the overall build time.

According to Phil Cox (General Manager East, DSI Underground), "Collaboration between the architects Arkhefield, steel fabricators Steel Fabrications Australia, and the galvanizers DSI Underground saw the design undergo significant revisions. The concrete piers and slabs were replaced with hot dip galvanized steel."

As a result, over 700 tonnes of galvanized structural steel and purlins were used in the construction of the Cruise Terminal building, the elevated walkway, and the car park. All

this steel was supplied by local steel mills, or ACRS approved mills (if the material was unavailable locally).

"The new lightweight galvanized steel truss modular walkway design was developed to enable 12 spans to be fully built on the ground – complete with louvres, roofing system and glass. Once each of the module spans was complete, they were lifted into their final position with a variety of mobile cranes. This reduced the working at height issue by more than 90% compared to the original pre-cast concrete floor design," said Cox.

"Another benefit of utilising the galvanized steel modular system approach was that the spans could be constructed at the same time as the wharf and piers. This saved a considerable amount of time, which was particularly important given the tight project schedule."

Technical and engineering innovation

With hot dip galvanizing chosen as the superior surface treatment, the challenges posed by the new design were identified early. Arkhefield, Steel Fabrications Australia and DSI Underground worked closely to ensure the best possible outcome for the project.

"Our galvanizing bath is 13m long x 1.8m wide x 3m deep. To alleviate any issues related to the width of our bath, the sides of the truss – which had stubs welded perpendicular to the top and bottom chords to facilitate the bolting in of the horizontal floor, roof and bracing steel members – were fabricated in a particular way," said Cox.

"With respect to the length constraint, all the trusses were split into lengths no longer than 12m. For instance, a 24m truss consisted of two 12m sections that were then bolted together on-site. This innovative design change allowed the trusses to be efficiently galvanized and transported to site without incurring significant additional transport costs."

"The new design also had to take into the consideration suitable venting and draining without compromising the aesthetics. All RHS trusses were internally vented, with a small inspection hole located in a position as to not detract from the visual appearance of the finished structure," said Cox.

Improved maintenance for reduced costs

As per AS/NZS 2312.2 and AS 4312, the Cruise Terminal is located in a C4 corrosivity marine environment. It is estimated that the exposed hot dip galvanized elements of the Cruise Terminal will have a minimum of 16 years to first maintenance in the extreme marine environment.

"With Lysaght Bondek® selected as the material of choice for the elevated walkway, extensive corrosivity testing was carried out. As a result of this sample testing, we decided to strip the pregalvanized Bondek® and hot dip galvanize it in order to achieve thicker coatings. This increased the coating thickness by approximately three times, considerably increasing the life span of the structure, and reducing ongoing maintenance costs.

"The high-profile nature of the project provides a real opportunity to highlight the benefits that hot dip galvanizing delivers, particularly when compared to pre-cast concrete installations. With design considerations integrated early in the planning process, even oversized galvanized steel assemblies can be practical, safe, and economically beneficial in the long-term," said Cox.

This project was awarded the 2020 Sorel Award for Industry Achievement by the Galvanizers Association of Australia. The Sorel Award recognises Stanislas Sorel who patented an industrial form of the hot dip galvanizing process in 1837, itself first developed in the European region by Paul Jacques Malouin in 1742. The Sorel Award is designed to highlight the high standards of design, fabrication, construction, and corrosion protection achieved when hot dip galvanizing features as a key component of a project.

This project was also the 2020 Australian Steel Institute (ASI) Winner for Queensland in the Engineering Projects division for Steel Fabrications Australia. Details of the award and other winners can be found here

Project Team

Client: Port of Brisbane

Builder: Hindmarsh

Architect: Arkhefield

Engineer: Calibre Engineers

Steel Fabricator: Steel Fabrications Australia (SFA)

Steel Detailer: CND Structural Services

Galvanizer: DSI Underground

We wish to thank Peter Golding of the GAA and acknowledge Sally Wood (sally@wordly.com.au) who as a freelance writer produced this article for the GAA.

In Loving Memory
GRAEME STUART CARR

07 May 1959 - 14 January 2021

Our DAD shared a special bond with us - fun family time encouragement support.

A positive influence in our lives, thank you for loving supporting and teaching us about morals values integrity love respect and living life to the fullest.

We will miss you forever.

He leaves behind his wife Marion daughters Tamryn Trisha grandsons Connor Eoin sons-in-law Sean Erik.

Graeme was born in PE and attended School in Frankfurt Germany. He started working at Duff Murray then joined Plascon in the lab and automotive sales. In 1987 he worked in Rosslyn Pretoria automotive paint. In 1989 he moved to Powder and Protective Coatings at Plascon and Courthaulds. From 2011 Graeme specialised in Marine/Protective Coatings with AkzoNobel.

A huge personal loss as Graeme was a beacon of integrity and values that we cherish in a friend and colleague

COLIN MERCER, Business Manager MEA

Monster Croc Galvanized for a Long Life in the NT

Darwin's largest crocodile – a whopping 9m long galvanized steel sculpture – was unveiled at the George Brown Darwin Botanic Gardens at the end of April 2020. The crocodile proudly overlooks the surrounding tropical vista from its vantage point outside the African-Madagascan garden. In addition to paying homage to Darwin's native estuarine crocodile, the sculpture also honours the barramundi, with one very unlucky fish trapped in the monster croc's mouth.

The crocodile is the fifth reptile sculpture to be donated by the Friends of the Darwin Botanic Gardens, using funds raised through their annual plant sale.

Friends of the Darwin Botanic Gardens Secretary, Peter Knibbs, confirmed that the artwork was one of the largest pieces acquired by the group. "This one will be impossible to beat, it's a significant piece of public art," he said.

Design and sculpture

Local artist Techy Machero was commissioned for the project in 2015 by the Friends of the Darwin Botanic Gardens. Machero spent a considerable amount of time researching crocodiles to make sure the sculpture was as lifelike as possible. She even enlisted the help and advice of veteran Northern Territory Ranger and croc-wrangler, Tommy Nichols. She also sought the advice of Darwin Galvanizing – the firm that double-dipped the monster croc for corrosion protection.

According to Paul Stone (General Manager, Darwin Galvanizing), "The crocodile is constructed from thousands and thousands of individual pieces of steel. The unique local artist, Techy, relied upon traditional artisan techniques to create the sculpture, as opposed to steel fabrication processes. She literally used an anvil and hammer to tap each individual piece into shape, over a period of about four or five years."

Why galvanizing?

As the leading local experts, Darwin Galvanizing was contracted by Techy Machero to undertake the galvanizing process.

"The sculpture was galvanized for improved corrosion protection. It will be sitting in the botanical gardens in Darwin for years, which is a very in humid environment – corrosion protection was essential," said Stone.

No other protective coating for steel provides the long life, durability and predictable performance of hot dip galvanizing. An alloy of its steel base, a galvanized coating is unique in matching the design and handling characteristics of steel.

In addition, in the presence of atmospheric moisture – such as the humid environment of the Darwin Botanic Gardens – the zinc oxide film is quickly converted to zinc hydroxide, and carbon dioxide present in the air reacts to form basic zinc carbonates. These stable inert compounds resist further action and ensure long life for the protective galvanized coating.

"In my opinion, galvanizing is the best corrosion protection known to man, so long as it's suitable for both the product and the environment. Something like this crocodile sculpture could have been painted, but paint simply wouldn't have been as cost effective, durable, or efficient," said Stone.

The galvanizing process: Conquering technical challenges

Darwin Galvanizing was presented with one major obstacle when it came to the crocodile: its enormous size.

"The crocodile snakes around and has a huge barramundi in its mouth. It is massive. It's 9m long, 4.7m wide and, from the ground to the top of its head, it's about 1.65m tall," explained Stone.

"Our tank is 10.5m long and 1.5m wide. So the length and width of the crocodile were not an issue. The issue was the 1.65m height of the crocodile."

"As a result, the technicalities were fairly unique because of the sheer size of the sculpture, and the manual handling required. At one point, I actually phoned Techy and told her that I was about 90% sure that it just wasn't going to work," said Stone.

"But, we assessed the risk and decided it was safe to go ahead. We had to roll the sculpture around as we were immersing it. It surprised me. I thought we might had have to submerge the sculpture three or four times to cover the entire surface, but we able to get it done in just two dips."

Given the technical challenges presented by the project, Darwin Galvanizing opted to undertake the work in non-operational hours. One Friday night, Darwin Galvanizing completed all the cleaning processes, from degreasing and pickling through to fluxing. Then, on the following Saturday, the actual galvanizing was performed.

"Once we had the crocodile suspended, we couldn't put it down on the ground. After the sculpture went through pickling

The artist, Techy Machero, sitting safely atop of her creation after installation.

process, it had to remain hanging up in air. So we decided to complete the job outside regular operating hours, rather than monopolise the use of our cranes and hold up production throughout the entire facility," said Stone.

"This crocodile was something I could never have contemplated galvanizing in my 25 years of experience, but the end result was great – the sculpture turned out really well."

Darwin Galvanizing is part of the Kingfield Galvanizing group, which was established in Melbourne in 1983. Over the years, Kingfield Galvanizing partnered with other businesses to expand their operations, opening new plants in Brisbane, Geelong, Christchurch, and Sydney. Darwin Galvanizing was established in 1997 and, in 2012, was restructured and a new, state of-the-art facility was built to support the local market needs.

Project Team

Sculptor & Fabricator: Techy Machero

Commissioned by: Friends of the Darwin Botanic Gardens

Galvanizer: Darwin Galvanizing

You can see a video of the crocodile on Facebook, here: *https://www.facebook.com/GeorgeBrownDarwinBotanicGardens/videos/2820360558033765/ ?t=0*

Or, visit the crocodile in person at the George Brown Botanic Gardens. The George Brown Darwin Botanic Gardens are two kilometres north of Darwin city. The gardens cover 42 hectares and are noted for their collections of north Australian and other tropical species.

Images from Darwin Galvanizing, ABC Darwin and Darwin Botanic Gardens.

We wish to thank Peter Golding of the GAA and acknowledge Sally Wood (sally@wordly.com.au) who as a freelance writer produced this article for the GAA.

Zinc Primers: An Overview

Metallic zinc as a protective primer

It is generally accepted that particles of metallic zinc applied to a steel surface in a paint matrix, in the form of a zinc primer, provide protection to the steel by a process of cathodic protection. In the presence of moisture as the electrolyte, the steel forms the cathode and the zinc the anode in the resultant corrosion cell. The steel, being the cathode, does not corrode whilst the zinc, being the anode, corrodes preferentially and protects the steel. This protection continues until the zinc in the paint matrix is consumed or depleted.[#1]

Hot dip galvanizing vs zinc rich paint

It must be remembered that it is metallic zinc that affords cathodic protection to steel and the extent of protection offered is directly proportional to the coating thickness with respect to hot dip galvanizing. A further factor to be considered is the environment to which these coatings would be exposed.

Care should therefore be taken when selecting zinc based coating systems for chemical environments. Zinc, being an amphoteric metal, is attacked by both acids and alkalis. Zinc should only be used in the pH range 6 to 12.5.[#2]

When considering zinc rich paints, only those that contain sufficient quantities of metallic zinc dust will provide cathodic protection. There must obviously be sufficient zinc particles present to ensure that they are in electrical contact with each other in order to provide a common anode. Individual isolated zinc particles dispersed in the paint binder will not provide protection as they would essentially be insulated from the substrate and each other. In accordance with ISO 12944, all zinc rich paints should contain a minimum of 80% zinc in the dry film in order to function as sacrificial primers.

A "Duplex Coating" is a term first introduced by Jan van Eijnsbergen of the Dutch Hot Dip Galvanizing Institute in the early 1950's. It describes the protection of steel by over coating hot dip galvanizing with an organic coating system. The purpose is to provide additional corrosion resistance, easy visibility, camouflage, or when a pleasing aesthetic appearance is necessary.

Duplex coating systems provide synergy by virtue of the fact that the durability of the combined hot dip galvanized / organic coating system is greater than the sum of the separate durabilities of the hot dip galvanizing and an organic coating layer applied directly to the steel substrate.

The reasons for this synergistic effect are as follows.

When moisture, oxygen and pollutants diffuse through a paint coating onto steel, rust soon forms at the interface. Since rust (a mixture of various hydrated iron oxides with varying compositions) has a volume which is approximately twice to three times the volume of the steel from which it has been formed, the paint coating will lose contact with the substrate and, depending upon its adhesion and cohesion, will start to crack and/or flake off.

When hot dip galvanized steel is the base of a paint system, the occurrence of moisture, oxygen and pollutants at the zinc / paint interface causes the pure zinc (or eta layer) to corrode slowly. However, these zinc corrosion products (mainly zinc oxide and zinc hydroxide) have a volume which is only 15 - 20% more than the volume of zinc from which they have been formed. These zinc corrosion products will block off small pores, craters or cracks in the paint coating[#3], thus conserving its protective properties over an extended period, provided that adequate adhesion of the paint coating was initially achieved.

The benefit of a metallic zinc primer such as hot dip galvanizing under an organic coating system is illustrated by the comparative photographs seen in *Figure 1*. The photograph on the left in *Figure 1*, shows a powder coated mild steel panel that has been exposed in a salt spray cabinet for 2 000 hours. The rust staining weeping from the scribe cuts shows that the underlying steel is corroding where the salt spray has gained access to the substrate. The coating

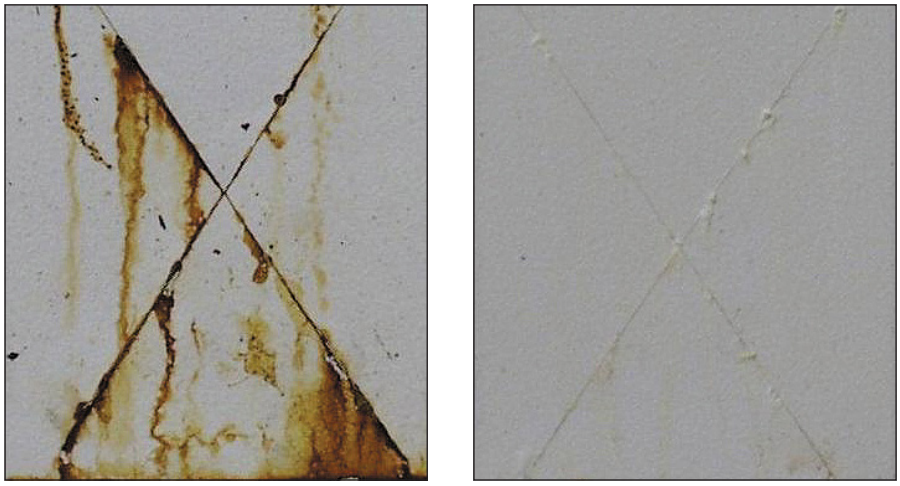

Figure 1: (Left) Powder coated mild steel – 2 000 hours salt spray.[#1] (Right) Powder coated continuous hot dip galvanized sheeting – Z275 – 2 000 hours salt spray.[#1] (right).
#1 Both coatings in photos 1 & 2 were scribed down to the steel substrate prior to exposure to the salt spray test.

adjacent to the scribes is being lifted by the voluminous iron corrosion products. The photograph on the right in *Figure 1*, shows a powder coated panel made from continuous hot dip galvanized sheeting – coating class Z275 (equates to about a 20µm coating thickness). In this instance the metallic zinc primer has provided cathodic protection to the underlying steel at the scribe cuts. The surrounding zinc is sacrificing itself to protect the steel, forming white zinc corrosion products. The solid volume of the zinc corrosion products is small and therefore the coating adjacent to the scribes has suffered little damage. After the same 2 000 hours period there is still sufficient zinc to prevent corrosion of the underlying steel. The sacrificial nature of zinc at the scribe points will in time deplete the surrounding zinc coating and as it recedes, leaving uncoated steel at the scribe point[#4], localised corrosion will commence. Maintenance painting repairs would then be required before the steel substrate becomes damaged.

In extenuating circumstances such as possible design restrictions, size of component, geographical location of the fabricator in relation to the galvanizer, or where hot dip galvanizing is impractical or impossible, it may have to be substituted by either inorganic or organic (epoxy) zinc.

It is beyond the scope of this article to cover the detailed pros and cons of hot dip galvanizing versus zinc rich paints but one of the main factors for consideration remains costs. A number of articles comparing the relative costs of hot dip galvanizing versus painting have been published.[#5]

The essential difference that must be appreciated is that hot dip galvanizing costs are calculated by mass of steel hot dip galvanized, whilst painting costs are based on area painted. Tables are available for most steel sections giving surface area by mass.

As a rule of thumb the following can be used:

Extra light steel	more than 40m^2/ton
Light steel	30 to 40 m^2/ton
Medium steel	20 to 30 m^2/ton
Heavy steel	less than 20 m^2/ton

In hot dip galvanizing, steel is subjected to a routine cleaning process, including degreasing, acid pickling and fluxing, with intermediate water rinsing, thereby creating a thoroughly clean surface, essential for hot dip galvanizing to take place. The resultant coating thickness is dependent on several factors including, chemical composition of the steel, steel thickness and surface roughness, as well as a number of other less important factors. In steel of thickness greater than 3mm but less than or equal to 6mm, the mean coating thickness is required to be at least 70µm but on steel thickness greater than 6mm the coating must be 85µm.

In painting the painter will abrasive blast clean the steel and then spray apply a suitable 75 micron thick (inorganic or organic) zinc rich primer coat for a protective coating system at a cost based on the total area of steel he has painted.

Case histories have shown that for steel sections up to some 35m^2/ton it is more cost effective to blast clean and paint whereas

The photos above show hot dip galvanized steel in an architectural application at the National Library, Pretoria, South Africa.

for steel sections with greater than 35m²/ton, it is more cost effective to hot dip galvanize. Obviously this cut off point varies with raw material and labour costs at any point in time. On the other hand the hot dip galvanizing will require thorough cleaning before the primer or intermediate coat can be applied. #6

The point is, however, that both methods of providing the required metallic zinc primer can be cost effective, depending upon circumstances. It is for this reason that in recent years both options have been given in protective coating specifications, leaving the final decision whether to hot dip galvanize or paint, up to market forces.

Many fabricators have a painting facility in their shops such that the fabricated steel moves through the wheelabrator and into the paint shop where it receives the primer, intermediate and sometimes the finishing coat before it is transported to site. If the steel is to be hot dip galvanized the fabricator has to transport the steel to the galvanizer and return it before applying the subsequent paint coatings. In order to make hot dip galvanizing cost effective in this instance the galvanizer needs a painting facility in order to apply the top coats without incurring further transport costs. The concept of applying paint at the galvanizers premises is available at a number of galvanizers throughout South Africa.#7

Clearly hot dip galvanized coatings and paint coatings complement each other in the protective coatings industry. However, there is still a perception in the market place that the galvanizers and paint manufacturers are in competition with each other.#8

Expert footnotes

#1 Zinc rich coatings can come as organic zinc rich paints or inorganic zinc rich paints and each has its own specific properties and role in the coating world. While inorganic zinc rich primers are tricky to apply they provide very good corrosion protection. Organic zinc rich coatings are formulated with a variety of binders e.g. epoxy or polyurethane and are relatively easy to apply.

#2 Although zinc is amphoteric, i.e. will corrode at pH less than 6 and above 12.5, if sufficiently over coated with a comprehensive organic coating system, it will provide better protection than the same paint coating system applied over plain carbon steel.

#3 All paint coatings in time become porous and this allows moisture to penetrate the coating.

#4 In comparison to a coating thickness of about 20µm, produced on class Z275 continuously galvanized sheet (ISO 3575), general hot dip galvanizing (ISO 1461) produces a thicker coating:, 45µm for steel less than 1.5mm thick to 85µm for steel greater than 6mm. The thicker the available coating, the longer the period of sacrificial protection at damaged areas such as the scribe points detailed in the article, before the onset of localised corrosion.

#5 Recent price comparisons indicate that hot dip galvanizing on its own is competitive when compared to an abrasive blast and a paint coating of about 75µm DFT of inorganic zinc rich paint, in steels from ultra light (70 to 120m²/ton) to heavy steel (25m²/ton). This comparison excludes the cost of independent substrate and coating inspection for the painted steelwork and additional transportation of the hot dip galvanized steel.

#6 A hot dip galvanized coating comprises a series of Fe/Zn alloy layers making up between 50 and 85% of the coating.

#7 In our opinion, the logistics of additional transport, concerns not only the galvanizers but many steel fabricators. Faced with stringent environmental regulations for applying paint, lack of skilled painting staff and general downsizing of expertise, this then forces many fabricators to outsource the painting stage. Furthermore, there are many hot dip galvanizers who have gained the necessary expertise to prepare and apply at least the primer coat, if not the entire coating system. Additionally, where this expertise is not available, some galvanizers can provide industrial painters with floor space, in which preparation and subsequent painting may take place.

#8 While there is merit in using a duplex coating where it is required, such as in the instances referred to in the article, there will in most instances be co-operation between the paint and hot dip galvanizing industries. However, when a single coating is specified that must be appropriate and cost effective, there will always be competition between the players of both industries.

Zinc Magic in Corrosion Control

Zinc and its discovery

Zinc is a magic metal that so few engineers appreciate for its multitude of applications and its versatility in use. In the corrosion world where we seek to extend the life of atmospherically exposed steel, we use zinc in galvanizing. Yet how many architects and consulting engineers truly appreciate the MAGIC that zinc performs all around us quietly protecting railways, bridges, concrete and mining structures from catastrophic failure due to corrosion.

The Romans knew about zinc but rarely used it, however it was refined in India between 1100 and 1500. Zinc refining took place in China in the 1500's and an East Indies vessel that sank off Sweden in 1745 was found to be carrying almost pure refined zinc from China. It was the German, Andreas Marggraf in 1746 who recognised zinc as a new metal.

Zinc and its chemistry

Zinc also plays a key function in our bodies. Zinc assists the enzyme carbonic anhydrase to catalyse the reaction of carbon dioxide and water, so without zinc we humans wouldn't survive. It's pure magic.

If a human being does not have enough zinc in his or her body then he or she cannot smell!

Zinc is a bluish-white, lustrous metal. It is brittle at ordinary temperatures but malleable at 100 to 150°C. It is a fair conductor of electricity and burns in air with the evolution of white clouds of the oxide.

Zinc and its magic

Zinc is employed to form numerous alloys with other metals. Brass, nickel silver, commercial bronze, spring bronze, soft solder, and aluminium solder are some of the more important zinc alloys.

Large quantities of zinc are used to produce die castings, which are used extensively by the automotive, electrical, and hardware industries.

RUST IS THE GREATEST ENEMY

of just about any type of metal, and its corrosive effects can be devastating. According to NASA, the cost of corrosion-related losses to United States industries totals approximately $276 billion annually, with the worldwide figure approaching $1 trillion.

Huge tonnages of zinc are used in SA to galvanize steel to prevent corrosion. Zinc oxide is a unique and very useful material for modern civilization. It is widely used in the manufacture of paints, rubber products, cosmetics, pharmaceuticals, floor coverings, plastics, printing inks, soap, storage batteries, textiles, electrical equipment, and other products. Zinc sulphide is used to make luminous dials, TV screens and fluorescent lights.

Zinc in corrosion control – true magic at work

Yet the magic we are interested in when we talk about zinc is its capacity to protect uncoated steel structures against premature corrosion and we call that the science of corrosion control.

If zinc is alloyed with aluminium it creates Galvalume or Zincalume and this is coated onto thin steel sheet and subsequently coated with an organic coating, to create long lasting roof sheeting for buildings. More zinc magic!

Where zinc really comes into its own is in hot dip galvanizing of steel items, structures and reinforcing steel for concrete. Once the hot dip galvanized item is exposed to the atmosphere then the zinc that is metallurgically bonded to the steel starts to perform its magic.

When we hot dip galvanize steel in a galvanizing kettle, there are a few things we need to do before we dip the steel in the molten zinc in the kettle. These include cleaning, rinsing, degreasing and fluxing before we dip in hot zinc.

Once the steel is removed from the molten zinc, it is ready either to be painted with an organic coating to give additional corrosion protection to the steel or it is left unpainted ready for installation.

Just a last word: when the steel is immersed in the molten zinc in the kettle, and then removed for cooling, this results in a metallurgical system that protects the underlying steel, although in actual fact the zinc is being slowly sacrificed to protect the steel. So, when next you are out and about, take time to see if you can spot a galvanized steel structure – look for the characteristic spangle. You will be amazed where galvanized steel appears and where the magic of zinc can be seen in action.

In Loving Memory
MARTIN GOSSAYN

23 March 1961 – 06 January 2021

Martin Gossayn was an integral part of the Corrosion Protection Industry in Southern Africa, especially in the light industrial segment. He started off his journey as a retail paint outlet and decorative painter in 1988 and ventured into steel coatings in 1989.

DRAM was established as a family business and to this day remains one. Martin grew his business with his wife Renee at his side. He took his small business which he started in an office in his Dad's business from 6 painters, to a staff complement at its peak of over 300 painters, 10 admin staff, 6 contract managers, a quantity surveyor and 2 safety officers.

DRAM became a household name for corrosion protection, coating in excess of 25 000 tonnes of steel a year. Martin took pride in the fact that DRAM was a contributor to the preparations for the 2010 Soccer World Cup, DRAM was involved in the airports, bus stations, Gautrain stations, general infrastructure as well as a few stadiums.

Martin took DRAM all over the African continent working in multiple African countries. He was at the forefront of paint specification negotiations between consulting engineers, steel fabricators and paint manufacturers and was responsible for the advancement of multiple paint specifications in the industry. Martin ensured that DRAM was always innovating the industry and ensured that he kept ahead of his opposition.

Martin befriended his clients and the paint suppliers and socialised with them on a regular basis. His legacy will live on in his family establishment, DRAM, which is now being run by his wife, son and daughter in whom he instilled the same love, passion and commitment to the industry as what he had.

A huge tree has fallen in the industry, he will be sorely missed.

From the KETTLE

The role specifiers and end-users have in selecting a corrosion control coating, suggests that all aspects of a hot dip galvanized coating be highlighted and if necessarily de-mystified. The intension of this series of surface conditions is to ensure that the customer or specifier has a greater understanding of the coating so that it is not necessarily rejected or accepted for the wrong reasons, resulting in wasted time for all personnel. See F32 and F33.

Legend
A Accept **R** Reject **REP** Repair

F32

DESCRIPTION:

Inappropriately small and/or incorrectly positioned vent holes can lead to reduced coating quality, destruction of the component and unsafe working conditions for the galvanizer due to potentially dangerous explosions.

CAUSE:

At hot dip galvanizing temperatures any moisture present in closed sections is rapidly converted to superheated steam, generating massive explosive forces, which could instantly remove up to 50 tons of molten zinc from the bath unless suitably vented. This has serious implications to both the safety of the galvanizing personnel as well as the sustainability of the business, while destroying the component at hand. For the safety of the galvanizing personnel and equipment it is essential that adequate venting is provided.

EFFECT / REMEDY:

By inserting correctly sized and positioned vent, fill and drainage holes in the tubular component or overlapped steel component, moist air is unlikely to be trapped. This will ensure acceptable quality and safe galvanizing. Refer to Steel Protection by Hot Dip Galvanizing and Duplex Coating Systems for details on vent, fill and drainage holes (refer to HDGASA).

ACCEPTABLE TO SANS 121:

R

ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:

R

Above and left: Inadequate vent holes can cause serious implications to both the safety of the galvanizing personnel as well as the sustainability of the business, while destroying the component at hand.

Below left and right: For the safety of the galvanizing personnel and equipment it is essential that adequate venting is provided.

F33

DESCRIPTION:

Insufficient and inappropriate vent, fill and drainage holes.

CAUSE:

Similar to F29 and F30. When vent holes are not appropriately positioned at the extremities of a section an air trap may result in premature internal corrosion implications.

EFFECT / REMEDY:

By positioning vent, fill and drainage holes at the absolute extremity of the tubular component or changing the design of tubular sections

Vent holes in the 3 capped poles above are hopelessly inadequate. Should appropriately sized holes be aesthetically unacceptable for whatsoever reasons, discuss with the selected galvanizer prior to order.

While the hole in the component above is adequate for drainage not all the molten zinc can escape. Recommend that additional smaller sized holes be included in opposite corners.

F33 continued

accordingly, air or molten zinc is unlikely to be trapped leading to acceptable quality and coating durability. Refer to Steel Protection by Hot Dip Galvanizing and Duplex Coating Systems for details on vent, fill and drainage holes (refer to HDGASA).

ACCEPTABLE TO SANS 121:

R

ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:

R

In the component above, having been in service for some time, surface corrosion was noticed on the outside of the pipe. The pipe was cut open revealing heavy localised corrosion of the steel substrate due to an air pocket that had occurred during hot dip galvanizing.

It is crucially important to ensure adequate and appropriate vent holes are included in all closed tubular components, to ensure potential air pockets are avoided.

Vent and fill holes in the above photo have been positioned a distance away from the two horizontal tubes and will lead to air pockets and pooled solidified zinc inside the vertical tubes. The formation of air pockets will lead to uncoated areas which will lead to premature corrosion.

In the components above, increase the vent hole size or discuss with the selected galvanizer.

In the components above, eliminate the half-moon end cap on both faces, increase the vent hole size or discuss with the selected galvanizer.

Current Vice President Graham Duk discusses Corrosion Fatigue with past President Rob White.

Technical Events

The CEO of Ion Exchange Safic Pty Ltd, Mr Gourish Chakravorty gave an informative virtual technical presentation titled "Alternative Sources of Water" on the 14th January. This was an exciting and informative topic to many as per the interest shown and covered sections such as whether to use Underground water, wastewater reuse or water desalination. CPD Points are available for this presentation for those who attended.

The next virtual presentation was presented by Anil Khera from Ion Exchange India Pty Ltd titled ""Deposit & Corrosion Control in open Recirculating Cooling Systems". Thank you to everyone who showed interest and participated.

On the 18th February Craig Woolhouse from Elcometer presented on "Profiled Surface Calibration". Thank you to everyone who showed interest and joined the presentation.

A copy of all these presentations is available on request.

To book your free presentation slot, please enquire on: events@corrisa.org.za.

Please also take note that this platform is also available for marketing presentations at a fee.

CorrISA Corporate Membership

We wish to thank all our longstanding and new members for their ongoing support. All renewed memberships have been updated on our website.

MEMBER	DATE JOINED
JOINED BETWEEN 1970 AND 2001	
BLASTRITE (PTY) LTD	1991
KANSAI PLASCON (PTY) LTD	1991
SOUTHEY HOLDINGS (PTY) LTD	1991
COLUMBUS STAINLESS (PTY) LTD	1991
DENSO SOUTH AFRICA (PTY) LTD	1993
MINTEK	1993
SAPPI SOUTHERN AFRICA LTD	1993
SIGMA COATINGS(PTY) LTD	1993
NORDBAK (PTY) LTD	1994
DEKRO PAINTS (PTY) LTD	1996
AFRIGRIT CC	1996
SPEC GROUP	1998
ABE CONSTRUCTION CHEMICALS	2000
DPA SPECIALIST CONSULTING ENGINEERS	2000
JOTUN PAINTS SOUTH AFRICA	2001
STONCOR AFRICA (PTY) LTD	2001
JOINED BETWEEN 2002 AND 2011	
NATIONAL URETHANE INDUSTRIES	2003
KARE INDUSTRIAL SUPPLIERS (PTY) LTD	2004
WACO AFRICA T/A SGB CAPE	2004
DRAM TRADING CC	2006
ISINYITHI CATHODIC PROTECTION	2007
SIMPLE ACTIVE TACTICS SA (PTY) LTD	2007
TOTAL CONTAMINATION CONTROL SA	2009
ASP ROPE ACCESS (PTY) LTD	2010
BAMR (PTY) LTD	2010
PARADIGM PROJECTS	2010
PRO PAINT MANUFACTURING (PTY) LTD	2010
BENGUELLA ENTERPRISES (PTY) LTD	2011
BLUCHEM COIL TREATMENT CT	2011
CDA (Reciprocal Member)	2011
IMESA (Reciprocal Member)	2011
JOINED BETWEEN 2012 AND 2015	
PIPE COATINGS CC	2012
THAPO GLOBAL CC t/a Thapo Industrial Rope Access	2012
NMT ELECTRODES (PTY) LTD	2013
SKYRIDERS ACCESS SPECIALISTS (PTY) LTD	2013
CATHTECT ENGINEERING (PTY) LTD	2014
ORYTECH (PTY) LTD	2014
ENERMECH ENGINEERING SERVICES	2015
HDGASA (Reciprocal Member)	2015
PATERSON & COOKE CONSULTING ENG	2015
POFU SUPPLY ON DEMAND	2015
SAINT (Reciprocal Member)	2015
SASSDA (Reciprocal Member)	2015
SECMET (PTY) LTD	2015
STOPAQ	2015
JOINED BETWEEN 2016 AND 2017	
AESSEAL (PTY) LTD	2016
BEYOND INFRADEV (PTY) LTD	2016
DEFELSKO	2016
OPTIMA COATINGS SA (PTY) LTD	2016
PLASCOAT SYSTEMS	2016
RAND WATER (Asset Member)	2016
REDEC	2016
REIGNITE (PTY) LTD	2016
SPECIALISED CLIMATE ENGINEERING (PTY) LTD	2016
STORM MACHINERY (PTY) LTD	2016
TRANSVAAL GALVANISERS (PTY) LTD	2016
TRENTBRIDGE ENGINEERING CC	2016
UNYAZI SALES AND SERVICES	2016
WEARTECH (PTY) LTD	2016
CAPITAL STAR STEEL	2017
ELECTRO SCAN CC	2017
SPS CORROSION PROTECT	2017
JOINED 2018 AND 2019	
AFSA (Reciprocal Member)	2018
BLYGOLD SA CAPE TOWN (PTY) LTD	2018
CONCRETE SOCIETY OF SA (Reciprocal Member)	2018
DCE CORROSION ENGINEERING (PTY) LTD	2018
EXXARO RESOURCES LIMITED	2018
J A M S	2018
PRO MAC PAINTS	2018
SURCOTEC (PTY) LTD	2018
CIVIL & POWER GENERATION PROJECTS	2019
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M R H BLASTING & COATING (PTY) LTD	2019
RERA PROJECTS	2019
SAIW (Reciprocal Member)	2019
SAPMA (Reciprocal Member)	2019
UDI ENGINEERING	2019
JOINED 2020	
AZVARIA (PTY) LTD	2020
BAREFOOT CONSTRUCTION & PROJECTS (PTY) LTD	2020
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DISA CATHODIC (PTY) LTD	2020
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INSTECH CALIBRATION SERVICES CC	2020
INTEGRITY ENVIRONMENTAL SOLUTIONS (PTY) LTD	2020
INTER SOUTHERN POWER (PTY) LTD T/A SPM SA	2020
MABRO ENGINEERING AND TECHNICAL SERVICES	2020
MGOLOSI CATHODIC PROTECTION SERVICES (PTY) LTD	2020
MURRAY & DICKSON CONSTRUCTION (PTY) LTD	2020
OCCA (Reciprocal Member)	2020
PATRICE ROPE WORKS (PTY) LTD	2020
PROCUSHION TRADE AND MAINTENANCE	2020
RSC INDUSTRIALS SERVICES (PTY) LTD	2020
RUBY BRUT INELEK (PTY) LTD	2020
SRS GLOBAL TRADING (PTY) LTD	2020
ZINCODIC	2020
JOINED 2021	
TMS GROUP INDUSTRIAL SERVICES (PTY) LTD	2021

Comment – Executive Director

It is hard to believe that we almost at the end the first quarter of 2021, and a few months away from the end of the Institute's fiscal year. The Corrosion Institute of Southern Africa continues to promote and advance the highest ethical and professional standards within our industry.

Training has already commenced and new relationships has been established. One of them was an opportunity for me to present at the Women in Mining Conference on "Corrosion Control and How it Impacts the Mining Industry." This presentation was well received by over 100 delegates within the mining sector. This was an amazing platform to showcase what the Institute's mandate and objectives are and how we serve the various sectors. Others were, re-establishing our relationships with our reciprocal members. These relationships are imperative for the growth of the Institute as an Industry Association registered with the DTI and eventually as a Professional Body.

With COVID protocols still being our new normal, we are in the process of converting our training courses to an e-learning platform. As most of you know due to the pandemic, we've also moved our Technical Presentation to an online platform. We aim to have a Virtual Technical Presentation twice a month, every first and third week to promote the reporting, discussion and publication of corrosion experience and knowledge. Should you have an interesting topic, we would like to feature you, kindly book your slot soonest. Technical Presentations are for free. Marketing Presentation option is also available at a fee

As I've mentioned before, instead of talking about new things to start, let's focus on those initiatives that have already commenced. I don't want to say, "I wish that we will..." or "I hope that..." This year we MUST make things happen! We have the targets and milestones clearly defined, so, let's do it!

Amidst the COVID restrictions there are exciting times for the Institute ahead and we encourage all members to take advantage of the many benefits CorrISA is offering. Let us know how we can best serve you!

Regards, Petra Mitchell

Comment – Chairman of KwaZulu Natal

CORRISA KZN committee would like to welcome all our members back. Let's hope that 2021 will be a prosperous year for all of us.

Firstly we would like to pass condolences to those members who have passed away due to covid. Their input into the world of corrosion protection was invaluable.

Even though we still have covid restrictions in place, we are planning a bumper year ahead.

We will conduct meetings in an approved manner or by Zoom meetings.

We are planning some very interesting plant (including a galvanizing plant) and factory visits as well as re-introducing our annual Golf and Family Fishing day, together with a general networking breakfast.

Kindly ensure all your contact details have been updated on the CorrISA database in order for us to maintain a clear line of communication.

Additionally we will be starting to implement an SMS message reminder to all of the members with regards to all up and coming events.

If any KZN members would like to offer a plant tour of their facilities kindly contact Karyn Albrecht or Marco Ashburner.

We have compiled a brilliant committee that are prepared to dedicate their time trying to get the KZN branch back to where it was 10 years ago. One incentive involves us working with the Institute and one of the Lead Instructors for CIP1 and 2 to increase the number of NACE and CorriSA courses hosted in KZN.

Kind Regards
Karyn Albrecht (Chairman) and Marco Ashburner (Vice Chairman)

Comment – Chairman of the Cape Region

2020 was a tough year for everyone. The COVID pandemic continues to be part of our everyday lives, and this is unlikely to change in the near future. We do hope that things can get back to some semblance of normality and face to face technical presentations can take place once again.

In the mean time we have resorted to online Virtual Technical presentations. If you are in a position to present please chat to us and we will try and find a suitable slot for you.

In February we had a very well attended virtual technical presentation from Craig Woolhouse of Elcometer entitled: Profiled Surface Calibration. International Standards including SSPC PA2, ASTM D 7091, ISO 8503 were addressed and questions such as: How do I calibrate a gauge on a profiled surface and How often should I calibrate a gauge were covered. There were 90 registrations and 70 attendees so that was very encouraging.

We would like to extend our thanks to Bryan Bauermeister for his involvement in the committee and his input. He has now relocated back to Johannesburg. We are planning on having a committee brainstorming get together to discuss plans for the rest of the year. If you are interested in being part of the committee then please feel free to contact us.

We do hope that our next face to face Technical Presentation / Site Visit will take place as soon as possible. We have a number of options in the pipeline.

Until then, keep well and stay safe.

Graham Duk on behalf of Dan Durler, Daryl Livesey, Flippie van Dyk, Gilbert Theron, Hilton Olivier, Indrin Naidoo, John Houston, Lucinda Blanchard, Pieter van Riet and Terry Smith

CorrISA Courses: 2020 – 2021

We would like to take the opportunity in wishing everyone a happy, healthy and prosperous 2021. Trust you all had a good festive/ holiday season.

We were fortunate enough to end the year with a CIP 1 and CIP 2 course back to back, both courses were well attended.

We had 12 students attend the CIP 1 course that was held from 23 - 28 November 2020. Thank you to our company members, Storm Machinery who hosted the practical day and Sigma Coatings for the paint, epoxy etc donation. Providers like yourself are always needed to ensure a smooth and successful training intervention. The Corrosion Institute of Southern Africa is very fortunate to be able to call on you for assistance in making our practical day such a success.

We had a very successful CIP 2 course from 30 November - 5 December 2020 with 17 students. Due to the COVID-19 social distancing, we had to hire the Big Tree Conference centre to ensure that we keep in the boundaries of all the COVID-19 protocols and social distancing.

The CIP 1 course scheduled for 25 - 29 January 2021 had to unfortunately be called off due to insufficient numbers. It seems as if the COVID story put a real spanner in the works.

The CP 1 Tester course took place in Midrand from 8 - 12 February 2021. 14 Students attended the course.

General Information

We have had many enquiries for a CIP 3 Peer Review. We have been in contact with NACE about a virual review. Herewith the reply from NACE:

We are currently on a hold for scheduling new Peer Reviews. We will let you know if there have been any updates or changes.

There have been many changes with regards to the CIP courses and certificates from NACE's side.

CIP 1 and CIP 2 courses are now 5 days. The practical exam will be held on the Friday afternoon, not on the Saturday.

Students have 4 years to obtain their certification, if retaken in the first year then they receive a 20% discount. If taken after the one year mark the student will need to pay full price for the course.

Students will no longer receive wallet cards but, instead have digital access. This allows the student to save their card in their wallet on their phone or anywhere accessible and show or send whenever needed. We have listed the link regarding this change: *https://naceinstitute.org/certification-resources/digital-badging*

Linda Hinrichsen, Course Administrator

CIP 1 Course: 23 - 28 November 2020.

CIP 2 Course: 30 November - 5 December 2020.

CP 1 Tester: 8 - 12 February 2021.

THE INSTITUTE AND EDITOR WOULD LIKE TO ACKNOWLEDGE THE ADVERTISERS AND THANK THEM FOR THEIR SUPPORT

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MAGAZINE SURVEY for the ongoing production of hard copy editions of Corrosion Exclusively

As the editor and producer of Corrosion Exclusively I have from inception in 2015 always felt that we would present two formats of the magazine

- *A printed version which would be packaged and posted to readers regardless of membership:*

Advantages	Disadvantages
Read on any occasion in the absence of one's computer / mobile	Printing, packaging and posting add to production costs
Easily filed for future reference	Post office not always reliable
	Postal delays

- *A digital version which would be sent via the internet:*

Advantages	Disadvantages
Read on any occasion using one's computer / mobile	Difficult to read due to size limitation of screen
Save printing, packaging and posting costs.	Reader must have internet
Easily filed for future reference	Could be inaccessible after filing
Instantaneous receipt	
More cost effective advertising rates	
Digital links to advertisers' and authors' websites	

Both versions have their appeal to different readership groups.

In view of the pandemic and how this has affected many businesses that normally support publications such as this, we have decided to conduct a readership survey.

We therefore invite you to kindly comment by emailing the editor at *editor@corrisa.org.za* with the following information (one can also access the survey on *Survey for the ongoing production of hard copy editions of Corrosion Exclusively*):

Name:		Email:		
Surname:		Mobile No.:		
Please tick:	Currently receive by:		Would prefer by:	
	post	email	post	email
	Reader (R) or Advertiser (A)	R	A	
Additional comments:				

THE CORROSION INSTITUTE OF SOUTHERN AFRICA

COURSE SCHEDULE 2021

NACE CIP 1 – Coating Inspector Program

15th – 19th March 2021	The CORē, Midrand
12th – 16th April 2021	KwaZulu Natal
24th – 28th May 2021	The CORē, Midrand
5th – 9th July 2021	The CORē, Midrand
13th – 17th September 2021	The CORē, Midrand
22nd – 26th November 2021	The CORē, Midrand

NACE CIP 2 – Coating Inspector Program

7th – 11th June 2021	The CORē, Midrand
6th – 10th December 2021	The CORē, Midrand

NACE CP 1 – Cathodic Protection Tester

30th August – 3rd September 2021	The CORē, Midrand

NACE CP 2 – Cathodic Protection Technician

3rd – 7th May 2021	The CORē, Midrand
4th – 8th October 2021	The CORē, Midrand

CorrISA – Corrosion Engineering

19th – 23rd July 2021	The CORē, Midrand
2nd – 6th August 2021	KwaZulu Natal
6th – 10th September 2021	Cape Town

CorrISA – Corrosion Management

14th – 15th July 2021	The CORē, Midrand

CorrISA – Not Just Rust

31st March 2021	KwaZulu Natal
7th April 2021	Cape Town
30th June 2021	The CORē, Midrand
25th August 2021	KwaZulu Natal
27th October 2021	The CORē, Midrand
24th November 2021	Cape Town

CorrISA CITWI – Corrosion in the Water Industry

1st – 4th June 2021	The CORē, Midrand
1st – 4th November 2021	The CORē, Midrand

NACE OCAT – Offhsore Corrosion Assessment Training

23rd – 27th August 2021	The CORē, Midrand

NACE – Corrosion Control in the Refining Industry

17th – 21st May 2021	KwaZulu Natal

NACE NPP – Nuclear Power Plant Training for Coating Inspectors

18th – 22nd October 2021	Cape Town

NACE – Marine Coating Technology

21st – 24th June 2021	KwaZulu Natal

NACE Corrosion & Protection of Concrete Structures and Buildings

17th – 18th May 2021	The CORē, Midrand

REGISTRATION LINK: https://docs.google.com/forms/d/1e9ZGDsMO1Sd8aXuCvys2bstXr5SrpVBxuqEQPK9IfUM/viewform?c=0&w=1

The Value of Third Party Coating Inspection

By Vanessa Sealy-Fisher, Isinyithi Corrosion Engineering

In a world where time is short, the application of coatings often occurs under extreme time pressure from the project. Deadlines often loom and the temptation to skimp on following the specification can be great.

The reality is that the Project Manager is often too busy and in all likelihood not suitably trained, to perform the coating inspection role necessary on the project. An independent 3rd party coating inspector speaks for the End Client and the project itself to ensure that the coating specification is indeed being complied with.

Since the qualified and independent 3rd party inspector brings an objective perspective to the project, there can be greater confidence that the final product meets the expectations envisaged during the design.

This is achieved with the aid of the coating specification and a detailed quality control plan. Independent inspection verifies that the quality objectives required by the specification are being achieved.

It is the responsibility of the coating applicator / contractor to meet the specification. The independent 3rd party inspector will be witnessing the work of the contractor and drawing attention to those areas of concern or where improvements are required. It is also important to remember that the Specification is always the guide and the Inspector cannot insist upon a performance level that is higher than that in the specification.

Given the pressures of looming deadlines and time constraints, it is critical to make the time at the start of the project for a kick-off meeting. This meeting facilitates clarification of what will and what won't be accepted based on the requirements of the specification in a congenial environment and helps smooth the way for a successful project. With everyone aware of the goals and standards from the start, the team works together to achieve the best possible outcome for the project.

Although the coating applicator may have their own inspector, double checking that standards and procedures are being maintained is important, especially on critical projects. The costs of having an independent inspector are usually outweighed by the savings accrued in avoiding rework, and reduced failures post application.

It goes without saying that the inspector will be observing and recording many of the aspects of the coating operation, including:

- Weather conditions
- Storage of the coating materials
- Surface cleanliness, including the aspects of
  - oil/grease removal,
  - salts removal,
  - ensuring the surface is free of dust and debris.
- weld preparation
- blasting
- adequate blast profile

The actual coating application itself also requires inspection, including

- the mixing of the components,
- the application methodology,
- time between blasting and coating
- overcoating intervals
- thicknesses of each layer of the coating as well as overall dry film thicknesses
- holiday detection

The challenges of coatings applied too thickly or too thinly can result in disastrous failure, so this is a key consideration.

In the grand scheme of the project, the coating application is a small process. And yet, the results of it going wrong can have catastrophic and long-reaching effects on the entire project and on its intended life.

Making sure that the coating is applied as carefully as possible with the best possible conformance to the specification really does give your project its best start in life. By using a dedicated independent coating inspector, there is great peace of mind that the resultant output meets the specification and that the final project will stand the test of time.

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- Analytical Tests.

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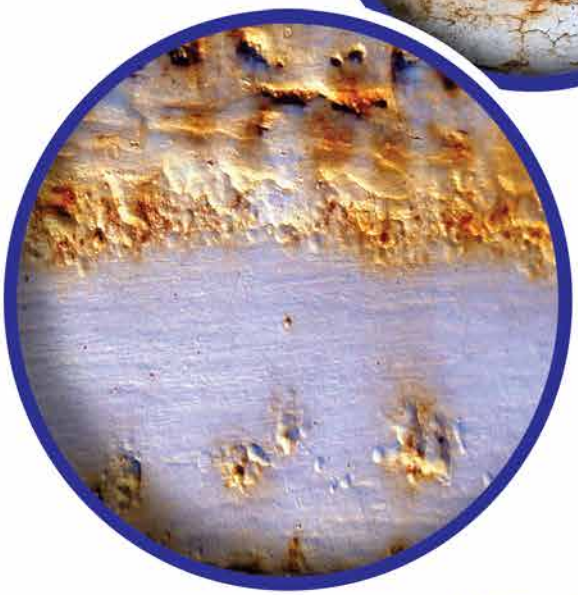
- Consultation on Corrosion Protection.



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The RUST Spot...

in conversation with Charles Dominion

Briefly explain your background and how you came to be involved in the Corrosion Institute. What year did you join?

Born in Rhodesia, I worked in the glass fibre industry, building small sailing dinghies, catamarans, and canoes in the early seventies. This later extended to building hang gliders, a blissful existence for a twenty something year old spirit with endless toys to enjoy. The business was sold though, and I with it.

One of my old bosses at the boat company, a civil engineer invited (rescued) me to join his business, exporting blasting sand to the Middle East. Ironically, there was not enough sand in Cape Town to supply the export market and the local ship repair industry, booming due to the closure of the Suez Canal in the late seventies. The industry looked for alternatives, finding resources of copper and platinum slag. Blastrite was born, a company I served for 25 years, specialising is granular abrasives for surface preparation from 1981 to 2006.

I discovered that the Corrosion Institute was the governing body of the industry, and joined, a decision in part to learn but also to make contacts that would inevitably help and commercially guide the business.

What was the state of the industry then and what role did you play within the institute?

I was privileged to meet "fathers" of the industry, like Michael Brett, Brian Callaghan, Greg Combrink, Eric Duligal and Walter Barnett et al, all of whom left lasting wisdom with me. But, the industry was unsophisticated and contractors did much as they pleased. Surface preparation quality suffered. A Nautilus contractor, Des Henley (one of my highly valued but now deceased mentors) opened my eyes to the efficacy of fine abrasives and those who know me will also know that this has been my hobby horse throughout my career. 95% of industrial coatings require surface profiles between 50 and 75 microns achieved using sub 1mm abrasives.

Talk about your years with the institute and what changes you've seen over that time

Over the years, the Institute has had many criticisms; as a club for academics, for being too commercial, for not attracting the "right" members and a variety of complaints. I too was critical, believing that the organisation could be more pro-active in developing real quality controls in surface preparation. It has been a tough road but the Institute has weathered these storms and now provides meaningful direction for its members, most significantly through the much recognised NACE courses offered.

What successes did you enjoy during your time with the institute and what role do you play now?

Probably the greatest success enjoyed through my association with the Institute was the opportunity to convince contractors that fine abrasives are far more cost effective than the 2 - 3mm abrasives used in the 1980's. There is still some scepticism amongst a few contractors today but results speak for themselves and we continue to promote the efficiencies of fine blasting abrasives.

If you could go back, what things (if any) would you do differently?

I have no regrets.

What advice do you have for the industry going forward?

Obey the rules of science. The squared and inverse squared rules and energy equation, discovered centuries ago by physicists are still ignored by some blasting contractors. Performance and Quality are everything. School physics is not complicated.

Anything else you feel would benefit our readers, especially in terms of how you see the future of the corrosion control industry?

The corrosion industry is a big picture, succinctly summed up by the late Walter Barnett as considering, the following:

1. Will the asset be in a corrosive **E**nvironment?
2. What is the expected **L**ife of the asset?
3. Is the asset **A**ccessible (for maintenance)?
4. What is the right corrosion prevention **S**pecification/method
5. Making sure the specification is **I**mplemented

ELASI – kindergarten rules of corrosion prevention, fundamental to our industry.

Something about yourself: your home, pets, sports, women in your life, travel, passions in life?

I am 1953 vintage, work from home running two small businesses; first, recycling steel shot and window glass producing abrasives, filtration media and other diversified products, saving waste ending up in landfills. The other company markets a ferrochrome based blasting abrasive trade named ecoblast®, targeted specifically in export markets.

My wife and I are passionate "Noordhoekers" in the Cape, and love where we live in a mountainside cottage with our "brak" and Siamese cat. I have travelled extensively in my career to many corners of the world. I find time for golf, swimming, reading nonfiction and walking, just beginning to accept that I may fall into the category of "semi-retired".

Our four children have left home, all independent except an autistic son who has been our life teacher.

CORROSION EXCLUSIVELY MAGAZINES

2015 – 2020

Should you wish to receive future editions of *Corrosion Exclusively,* kindly advise us or if you wish to refer to back issue copies from Vol. 1 Issue 1 in October 2015 to date these can be downloaded from the following link – *www.corrosioninstitute.org.za/category*

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