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# CORROSION & MATERIALS

**Vol 42 No 3**, August 2017
ISSN 1326-1932

## PROTECTIVE COATINGS FEATURE

## Inside this Issue:

# CORROSION & PREVENTION 2017

PROUDLY PRESENTED BY:

MAJOR SPONSOR:

## 12 – 15 NOVEMBER 2017 | SYDNEY, AUSTRALIA

**CONFERENCE.CORROSION.COM.AU**







## TECHNICAL PROGRAM

For the full list of papers based on abstracts received which have been provisionally accepted for C&P2017 by the Conference Technical Committee please visit the Conference website.

Submitted papers are subject to peer review prior to being officially accepted for C&P2017.

The final program for C&P2017 will be available on the Conference website in September 2017.

## SPONSORSHIP AND EXHIBITION

**There are limited sponsorship and exhibition opportunities left.**

For further information, please contact Lucy Krelle, Event Manager at the Australasian Corrosion Association +61 3 9890 4833 or email lkrelle@corrosion.com.au who will assist you with your enquiry.

## THE DESTINATION

### Sydney

Known the world over as Australia's 'Harbour City', Sydney is blessed with stunning natural landscapes and a near-perfect climate. Living is serious business in Sydney which is fun loving and full of energy. Delegates will have the opportunity to choose from the many attractions that Sydney and the surrounds have to offer, with activities to suit all tastes ranging from fine restaurants, arts and culture, shopping, family attractions, visiting the iconic Sydney Opera House or Sydney Harbour Bridge, pristine beaches or Taronga Zoo.

Sydney is also home to world-class meeting infrastructure and accommodation options. Just as importantly, it offers easy accessibility between the airport, conference facilities and the city centre, and is a safe and stable destination for international visitors and locals alike.

## ACCOMMODATION

WALDRONSMITH Management, have arranged special rates at a number of hotels within walking distance of the International Convention Centre. All room rates are based on room only, unless otherwise stated. A list of hotels and accommodation rates are available via the conference website where delegates may book their accommodation online: **conference.corrosion.com.au**

**THE FINAL PROGRAM FOR C&P2017 WILL BE AVAILABLE ON THE CONFERENCE WEBSITE IN SEPTEMBER 2017.**

## PLENARY LECTURERS

**Maria Forsyth**
Australian Laureate Fellow
Chair Electromaterials and Corrosion Sciences
Deakin University, Australia

**P.F. Thompson Memorial Lecture**
Presentation Title:
**Controlling Corrosion with Chemistry**

**Nick Birbilis**
Woodside Innovation Chair and Head, Department of Materials Science and Engineering Monash University, Australia

Presentation Title:
**Corrosion of Emerging Materials**

**Miles Buckhurst**
Global Concept Director – HPI
Jotun, Norway

Presentation Title:
**The Advantages of Heat Resistant Composites**

**Professor Jing-Li Luo**
Department of Chemical and Materials Engineering
University of Alberta, Canada

Presentation Title:
**The Synergism of Electrochemical and Mechanical Factors in Materials Degradation**

**Professor Peter Robery**
Director, Robery Forensic Engineering Ltd

Presentation Title:
**Effective Corrosion Management of Reinforced Concrete Assets**

**Dr Brian Skerry**
Global Director – Corrosion Programs
The Sherwin-Williams Company, USA

Presentation Title:
**Corrosion Prevention Coatings — From Noah's Ark to Nanotechnology**

## PARTNER PROGRAM

All Partner Program registrations include entry to all social functions with the exception of the ACA Foundation Fundraising Event, Monday 13 November 2017. Full details, costs and registration for the Partner Program are available via the conference website. *Note – Bookings will be subject to availability (limit 30). Attendees must be 16 years old or over. No concession prices available.*

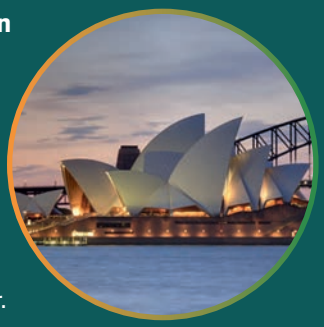
### Sunday 12 November 2017

**Welcome Function**
Doltone House, Jones Bay Wharf
6:30 – 9:30pm
A three hour cocktail function

### Monday 13 November 2017

**Blue Mountains Day Tour, lunch at Boiler House Cafe**
Enjoy a beautiful 2 course meal and glass of wine as you look over the magnificent views of the Megalong Valley Sisters Lookout.


**Exhibition Opening Function**
5.30 – 7.00pm
ICC Sydney (The Gallery)



### Tuesday 14 November 2017

**Sydney Opera House Guided Tour**
Prepare to take in all the mystery and majesty of a one hour Sydney Opera House Tour.

**ACA Awards Dinner**
7:00pm – midnight
A five hour, three course sit down dinner
ICC Sydney (Grand Ballroom)

### Wednesday 15 November 2017

**Captain Cook Long Lunch Cruise**
Enjoy all that Sydney has to offer when you climb aboard the Captain Cook Cruise! Including three course Contemporary Australian a la carte dining, popular Harbour sights and million dollar views!

**Farewell Function**
4:00 – 6:00pm
A two hour cocktail function
ICC Sydney (Cockle Bay Room Foyer)

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***Corrosion & Materials***

*Corrosion & Materials* is the official publication of The Australasian Corrosion Association Inc (ACA). Published quarterly, *Corrosion & Materials* has a distribution of 2,500 to ACA members and other interested parties. Each issue features a range of news, information, articles, profiles and peer reviewed technical papers. *Corrosion & Materials* publishes original, previously unpublished papers under the categories 'Research' and 'Professional Practice'. All papers are peer reviewed by at least two anonymous referees prior to publication and qualify for inclusion in the list which an author and his or her institution can submit for the ARC 'Excellence in Research Australia' list of recognised research publications. Please refer to the Author Guidelines at www.corrosion.com.au before you submit a paper to Tracey Winn at twinn@corrosion.com.au

ACA also welcomes short articles (technical notes, practical pieces, project profiles, etc.) between 500 – 1,500 words with high resolution photos for editorial review. Please refer to the Article Guidelines at www.corrosion.com.au before you submit a short article to Tracey Winn at twinn@corrosion.com.au

**The Australasian Corrosion Association Inc**

The ACA is a not-for-profit, membership Association which disseminates information on corrosion and its prevention or control by providing training, seminars, conferences, publications and other activities.

**Front Cover Photo:** *The Makatote Viaduct, North Island, NZ. Photo courtesy TBS Group. Photographer: Chris Parker.*


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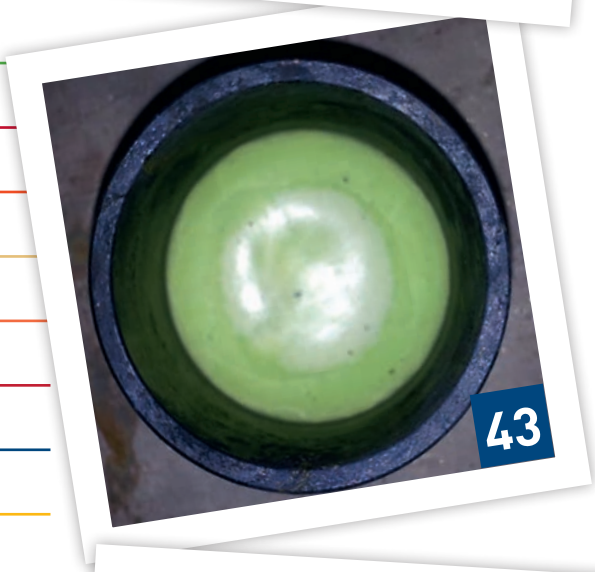


**Dean Wall**
*Chairman*

Greetings everyone, well 6 months have gone by and it will be 7 by the time you read this message. The years are rolling by quickly these days as we are all busy trying to disseminate the corrosion message.

The ACA recently held its AGM in Sydney prior to a NSW branch event dinner, which was well attended and I had the pleasure of delivering our annual results to the membership.

Our Board also met in April in Sydney and we were joined by our Foundation chairman Warren Green who shared his plans for the Foundation. We also discussed what we as a Board can do to continue to help facilitate the Foundation's message and ongoing commitment to support the corrosion scholarships and awards.

In my last Chairman's column, I mentioned we have seen some challenging times for our association. The Industry we all work in continues to be somewhat affected by market segment down turns in Mining and Oil and Gas and we all continue to be challenged to deliver and achieve targets. There is however some distant light at the end of the tunnel with some industry indicators showing signs of recovery and we at the ACA are designing and changing our delivery of courses and seminars to meet some of these changes.

The ACA's vision is that 'corrosion is managed sustainably and cost effectively to ensure the health and safety of the community and protection of the environment'.

The ACA currently has over 2,000 members segmented into asset owners, suppliers, contractors, consultants and researchers.

Coating applicators represent our largest member segment and include members such as: Action Alliance Group, Cape, Contract Resources, Eptec, Favcote, Hertel, IPCQ, Kaefer Integrated, Mac Coatings, Mattioli, McElligotts, Modern, Tranzblast and many more.This group now has its own representative technical group within the ACA, with the formation in Auckland last of year of a Contractors Group chaired and lead amicably by Justin Rigby (himself an ex contractor now inspection services consultant).

The group has asked the ACA Board through our education portfolio to investigate how we better map career paths within the corrosion mitigation industry for applicators/contractors. Ross Boucher our new BDM, Wesley Fawaz E.O.,the Education Committee and myself have all been busy investigating how we will do this by way of supporting a structured career path.

The Australasian Corrosion Industry developed qualified training for our applicators some years back in Surface Prep/Application and various RTO's can deliver this. We as the industry's voice need to work with them and help facilitate better access to this Australasian Approved Certified Training which is welcomed by Government and local industry supporters.

I encourage Asset Owners, Specifiers, Painting Contractors and Coating Suppliers alike to support such courses and recommend that you specify that contractors qualify their employees by training of blasters and painters for better delivery of quality work in Australasia.

We can all help to raise the profile of the Certificate III in Surface Preparation and Coating. Stay tuned for further developments on this. Go to our newly refreshed website which now is much easier to navigate and utilise on hand held devices and access relevant corrosion training courses, seminars and preventative information.

In closing and on behalf of my Board team, I thank you for your ongoing support of our Corrosion Association and ask you to refer all new potential members to Ross Boucher.

I wish you every success for the remainder of 2017.

**Dean Wall**
*Chairman*

# ACA 2017 Events

Part of the role of the ACA is to organise events that bring together industry experts to present on new technologies, updates to standards, and share knowledge and experiences via case studies on a variety of projects. Here are the events planned for the rest of 2017.

## August

**Introduction to Corrosion**
Thursday 24 August | Perth | Seasons of Perth

**Corrosion & Asset Management**
Thursday 31 August | Sydney | Engineers Australia, Sydney Division

## September

**Protective Coatings**
14 September | Hobart | Salamanca Inn

## October

**Corrosion in the Oil & Gas Industries**
Tuesday 10 October | New Plymouth | Quality Hotel Plymouth International

## November

**Corrosion & Prevention**
Sunday 12 – Wednesday 15 November | Sydney | International Conference Centre

### Branch Events

Each of the 8 ACA Branches will conduct regular technical events throughout 2017. To enquire, you may contact your local Branch at the following email addresses:

New South Wales: nsw@corrosion.com.au
New Zealand: nz@corrosion.com.au
Newcastle: ncl@corrosion.com.au
Queensland: qld@corrosion.com.au
South Australia: sa@corrosion.com.au
Tasmania: tas@corrosion.com.au
Victoria: vic@corrosion.com.au
Western Australia: wa@corrosion.com.au

### YCG Events

Targeting individuals under 35, new to the corrosion industry and/or interested in the corrosion industry, the ACA Young Corrosion Professionals conduct regular events. For further details email ycg@corrosion.com.au or go to www.corrosion.com.au

ACA YCG
THE AUSTRALASIAN CORROSION ASSOCIATION INC
YOUNG CORROSION GROUP

# ACA Call for Director Nominations

## Nominations for ACA members to serve on the ACA Board are now open.

**The ACA Board are seeking skills in:**

- Marketing & Communications
- Professional Education & Training
- Corporate Strategy
- Legal
- Finance & Accounting
- Corporate Governance & Risk
- Previous Board Representation
- Corrosion Related Industrial Experience

**Further details and the Board Nomination Form are available at www.corrosion.com.au — nominations close Friday 15 September 2017.**

**Wesley Fawaz**
*Executive Officer*

The value in ACA membership is the opportunity to 'Learn & Connect to Protect against Corrosion' and the ACA offers this value through various benefits of Knowledge, Resources, Community and Recognition. This is the fresh messaging Ross Boucher our new Sales & Business Development Manager will be promoting throughout industry to new and existing members.

The Brian Cherry International Concrete Symposium held last month in Melbourne illustrates this value of the ACA. The ACA recognised the educational leadership Brian Cherry has provided our community over the past few decades by organising eleven international experts who passed on their knowledge (just like Brian has to many ACA members for many years) on reinforced concrete corrosion, protection, repair & durability. And for those who were unable to attend, the ACA has published the peer reviewed papers from these international experts and these are now available as a resource through the ACA.

I know Brian was very pleased with the attendance and support by industry of the Symposium and it was an honour for the ACA to formally acknowledge his education, research and investigative works in various fields of corrosion science and engineering and his support of the Association. The ACA must also again thank Warren Green for his international connections and dedication to making this event a reality.

The success of the recent joint ACA/APGA Pipeline Corrosion Management seminar with over 80 delegates highlights the importance of the ACA building relationships with other industry bodies and utilising these vehicles to spread our message. Our next joint venture is this month's seminar in Sydney with the Asset Management Council (AMC) and we are also in early discussions with the AMC on a joint training course on how corrosion prevention management fits into the asset management standard ISO 55000.

The ACA continues to work away at expanding our training offerings, and is currently developing a selection of its courses online and is in discussions with international bodies such as the Institute of Materials Malaysia, NACE India, European Federation of Corrosion and of course NACE to offer our training overseas.

In just three months now, we will all be gathering in Sydney for the C&P2017 conference. I urge all of you to make the effort to register now and get to the convention centre to continue to build your relationships. We also need to value the sponsors and exhibitors, who continually provide the necessary additional financial assistance for the conference.

All the best for the lead up to the end of the year.

**Wesley Fawaz**
*Executive Officer*
wesley.fawaz@corrosion.com.au







# ACA Training Calendar 2017

All registrations are subject to ACA's published terms, conditions and policies

## ACA/ACRA Corrosion & Protection of Concrete Structures

*Member $1115 Non-member $1395*

**Brisbane September 11-12**

## ACA Coating Selection & Specification

*Member $1560 Non-member $1900*

**New Zealand August 28-30**

**Melbourne October 16-18**

## Corrosion Technology Certificate

*(Also offered as Home Study)**

*Member $2330 Non-member $2730*

**New Zealand October 2-6**

**Melbourne November 27 - December 1**

**Start any time*

## Hot Dip Galvanizing Inspector Program

*Member $1560 Non-member $1900*

**Sydney September 14-15**

**Perth October 23-24**

**New Zealand November 28-29**

## NACE Cathodic Protection Program CP 1 – Tester

*Australia Member $3335 Non-member $3670*
*Thailand Member $2600 Non-member $2850*

**Perth October 9-13**

**Thailand October 30 - November 3**

## NACE Cathodic Protection Program CP 2 – Technician

*Australia Member $3335 Non-member $3670*
*Thailand Member $2600 Non-member $2850*

**Perth October 16-20**

**Thailand November 6-10**

## NACE Coating Inspection Program Level 1

*Australia Member $3740 Non-member $4275*
*Thailand Member $2950 Non-member $3180*

**Brisbane July 31 - August 5**

**Perth September 11-16**

**New Zealand October 9-14**

**Sydney November 6-11**

**Thailand November 27-December 2**

**All Australian course fees listed are GST inclusive. All NZ and Thailand course fees are exempt from GST.**

To calculate the fee pre-GST, divide the fee by 1.1

## NACE Coating Inspection Program Level 2

*Australia Member $3740 Non-member $4275*
*Thailand Member $2950 Non-member $3180*

**Brisbane August 7-12**

**Perth September 18-23**

**Thailand December 4-9**

**Prerequisites now apply to this course.**

## NACE Pipeline Corrosion Integrity Management

*Member $2950 Non-member $3250*

**Melbourne September 4-8**

## SSPC Concrete Coating Inspection Program

*Level 1 $3000 Level 1 and 2 $3500*

**Melbourne October 9-14**

## IN-HOUSE TRAINING

**Did you know that you can have ACA's suite of courses come to you?**

The ACA can present any of its courses exclusively for an organisation; we can also tailor any course to your organisation's specific needs. Please contact the ACA's training department on +61 03 9890 483 or aca@corrosion.com.au

# Fantastic four for CCE

Corrosion Control Engineering (CCE) has added another NACE CP-4 Cathodic Protection Specialist to its senior engineering team. Ryan McKay joins CCE's Queensland office as Engineering Manager, and is CCE's fourth NACE certified CP Specialist.

Ryan is a Canadian citizen who previously worked for Corrpro Canada, and most recently, TransCanada Pipelines where he was a prominent member of their CP and Stress Corrosion Cracking (SCC) Threat Management teams. With 11 years of experience in CP, predominantly in the pipeline industry, Ryan will undoubtedly complement CCE's Brisbane operation, and will be able to share his North American knowledge and expertise on CP and SCC with pipeline owners all over Australasia.

Ryan has successfully completed the NACE CP Interference, CP-2, CP-3 and CP-4 training courses, and by joining CCE, significantly adds to their wealth of CP qualifications and capability. In May this year, seven corrosion engineers and technicians from CCE's Brisbane office successfully completed their NACE CP-2 Certification. CCE's Queensland operation continues to develop its NACE qualified CP personnel, with a current total of nine CP-2's and a CP-4.

The NACE CP-4 Specialist is the highest level of CP qualification offered by NACE and CCE now has a total of four senior engineers with this certification; one in each of their major Australian offices: Brisbane, Sydney, Melbourne & Perth; more than any other company in Australasia.

**The ACA offers NACE CP1 Tester and CP2 Technician as part of its various Training Courses.**

*Ryan McKay*

# Research to combat corrosion in demanding environments

A new multimillion pound collaborative research project led by BP and the University of Manchester could help to dramatically reduce the impact that surface degradation processes such as corrosion and wear have on industry worldwide.

Corrosion and wear processes have very significant societal, economic and safety implications for industry. From tools and machinery to oil pipes, platforms and refineries, many industrial assets are susceptible to these surface degradation problems. This is especially true when they're exposed to demanding environments that the oil and gas sector encounters.

According to NACE International, the worldwide corrosion authority, it is estimated that the global annual costs related to corrosion alone are greater than $2T. Despite this large economic impact, the fundamental processes of corrosion are poorly understood and industry relies on field experience for its management.

Professor Philip Withers, the University of Manchester's Regius Professor of Materials and the Principal Investigator on the project, said: "Although there have been impressive strides in the empirical understanding of corrosion, many of the underpinning assumptions and industrial practices date back decades."

But this could all change with a new collaborative research project, 'Preventing Surface Degradation in Demanding Environments', funded by the Engineering and Physical Sciences Research Council (EPSRC). The project brings together world class researchers from BP, the University of Manchester, Imperial College London and the University of Cambridge, who already work together on corrosion research through the BP International Centre for Advanced Materials (BP-ICAM), plus additional expertise from the Universities of Edinburgh and Leeds.

*Story courtesy: www.manchester.ac.uk*

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# 2017 WA Heritage Awards

Ian MacLeod recently received a Professional Contribution award from the Heritage Council of WA for his outstanding contribution to Western Australia's cultural heritage. Renowned for his generosity in sharing his remarkable knowledge with others, his passion for arresting decay in all forms has lead to improved Australian and international conservation management practices for shipwrecks, heritage buildings and collections.

Well done IMac from all your friends at the ACA.


# Color-Changing Paint Comes with One Caveat

The ongoing war sparked by the world's blackest black paint has seen another volley, as British artist Stuart Semple has released a new color-changing paint available to anyone—except Anish Kapoor.

Kapoor, a well-known British sculptor, has been banned from using Semple's latest paints, Phaze and Shift, after previously being banned from several of Semple's other product lines.

**Color War**

This conflict between Kapoor and Semple all began when Kapoor brokered a deal with Surrey Nanosystems, the creator of Vantablack—the world's blackest black—to be the only artist to work with Vantablack. The color had chiefly been marketed for military and aerospace applications previously, and Surrey awarded exclusive rights for a given application.

"Because we didn't have the bandwidth to work with more than one [artist]—we're an engineering company—we decided Anish would be perfect," Ben Jensen, the CTO at Surrey NanoSystems, told *Wired*. "His life's work had revolved around light reflection and voids."

What might work in the industry doesn't necessarily translate in the art world, and neither the artist nor the company could foresee the ensuing backlash.

In response to Kapoor gaining exclusive rights to Vantablack, Semple began a tongue-in-cheek series of product releases that were open to all, except one. Semple banned Kapoor from using his World's Pinkest Pink, which was part of his line that includes the World's Greenest Green, the World's Most Glittery Glitter and a cherry-scented version of Vantablack.

Kapoor responded by obtaining Semple's pink product and posting a photo to Instagram showing the pigment with a derogatory hand gesture.

"This whole color war has gone too far," Semple said after the incident. "He's hoarding the black to make wristwatches, run off with my Pink and given everyone the finger. We've got a better black now so it's time to bury the hatchet."

Kapoor insists that Vantablack was not originally created for artistic use.

**Phaze and Shift**

The newest products from Semple are color-changing paints, Phaze and Shift. Phaze leaves an ultra-matte coat that changes from purple to bright pink when exposed to heat over 80 degrees Fahrenheit. Shift can be applied over Semple's Blackest Black to form a multi-colored, almost iridescent sheen.

The secret behind the paint's ability to change color? Chiral nematic liquid crystal. Semple has described it as "living substance, more expensive than gold." The liquid crystal is sold in a bottle of rainbow fluid, which needs to be stored in a refrigerator and shaken once in a while to keep it "alive."

"Every time I see a new piece of work on the #sharetheblack hashtag I feel so excited, and I know that it proves to Kapoor and the creators of Vantablack that color hoarding and robbing are wrong," Semple said to *Creators*.

Semple has, of course, banned Kapoor from using the color-changing coating.

*Story courtesy: www.paintsquare.com*

*Stuart Semple's color-changing Phaze & Shift paints in action.* Courtesy of Stuart Semple.

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# *Queen Mary* exterior to be treated for corrosion, new paint to restore ship's original colours

For the first time in over 15 years, the *Queen Mary*'s exterior will be painted, to be restored to its original colours with the job expected to take about eight months.

This morning, Urban Commons, the leaseholder of the Queen Mary, and Mayor Robert Garcia celebrated the beginning of restoration with the first ceremonial brushstrokes painting the floating hotel's Sports Deck.

Monday also marked the beginning of another major task, treating the corrosion that has built up on the ship's exterior over the past 80 years. Using an environmentally friendly coating, Maxon-CRS, to eliminate existing oxidation and prevent future rust, Urban Commons will start with the exterior and gradually work their way to the interior.

"It's a momentous day," John Jenkins, vice president of asset management with Urban Commons said. "We are undertaking one of the largest paint jobs the city has ever seen."

And it's a paint job that simply can't wait. A report released in March "revealed that the *Queen* needed some $289 million in urgent repairs to prevent the hull from collapsing and flooding within the next few years," according to an article written in March on Urban Commons' plans for the Long Beach landmark and the land surrounding it.

"What you're going to see over the course of this next year and as this project completes [...] this ship is going to be radiant, it's going to look fantastic," Garcia said. "People are going to be even more excited and proud to be a part of its history, and its future as well."

In 1967 at the end of the *Queen Mary*'s ocean-faring life and when it landed in Long Beach, the city transformed the vessel into a shoreside attraction and hotel, sandblasting some 320 tons of paint from the hull of the ship, Commodore Everette Hoard said.

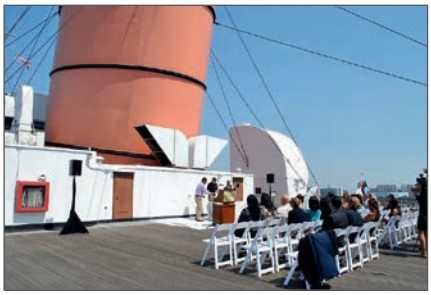
"Some of the paint chips were more than an inch thick, and sandwiched between the colors of the peacetime layers were the war time service layers," Hoard continued. "*The Queen Mary*'s heroic war time service where she carried some 810,000 military personnel to Europe in the pursuit of peace."

Approximately 240,000 square feet will be repainted, with the ship restored to its original colors, Garcia said. The largest impact of the restoration will be visible on the smokestacks, which will be a slightly different color when finished.

"I'm especially excited today because this ship is finally getting the paint job that it deserves," Garcia said. "I'm really proud and thankful to Urban Commons for making the investment and partnering with the city to ensure that the ship looks in prime shape."

You can follow Urban Commons' renovation of the ship on the *Queen Mary*'s Facebook page.

*Story and Photos courtesy Asia Morris at www.lbpost.com*




# NACE International Association Awards

Each year NACE recognises individuals who have made significant and lasting contributions to the corrosion industry through the Association's Award Program. Congratulations to Brian Kinsella for being honored as a NACE Fellow.

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# Innovation: SPA's New Discrete Anode for Concrete Application

Discrete anodes in concrete have been used extensively in reinforced concrete structures especially for concrete elements located in tidal and splash zones.

Due to their encapsulation within the concrete, discrete anodes eliminate the risk of grout acidification which is caused by sea water in splash zones. These anodes are proven to be sound and highly effective for the corrosion prevention of reinforced concrete piles, beams and headstocks.

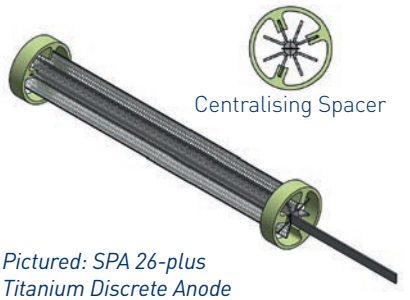
A new state-of-the-art development from Savcor Products Australia improves and economises the installation process for discrete anodes in concrete.

The new patented SPA 18-plus and SPA 26-plus anodes incorporate centralised spacers which centre the anode within the designated hole eliminating potential short circuits between the anode and rebar by providing sufficient grout cover to encapsulate the ribbon mesh. This further eliminates the need for any down-the-hole covermeter testing and multiple drilling into concrete to find the appropriate locations for installation.

The advantages of the new design include:

- Major reduction in cost for anode installation.
- Eliminates weakening of the structure from excessive drilling.
- Very fast installation.
- Elimination of short circuits between anode and rebar.
- Major reduction in engineering time during site testing.

This patented invention will guarantee major reductions in the cost of corrosion prevention by eliminating multiple holes and unnecessary drilling into existing concrete, and significantly reducing engineering time during site testing.




*Pictured: SPA 26-plus Titanium Discrete Anode*

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International

ASSET MANAGEMENT COUNCIL

# Applying Corrosion Prevention & Structural Integrity into Asset Management to save 3% of GDP*

## 31 August 2017 | Sydney

Modern asset management practices help organisations improve efficiency and reduce costs by identifying the lowest lifecycle cost construction, maintenance and renewal options.

Because corrosion influences materials selection, maintenance planning and renewals decisions, as well as influencing product quality and risk management, understanding corrosion is an essential part of successful asset management.

**This joint Australasian Corrosion Association & Asset Management Council one day seminar provides an opportunity to see how the application of Asset Management can assist organisations to deal with and manage corrosion, both in theory and through real-world examples.**

# Protective Coatings for Asset Preservation

**14 September 2017**

**Hobart**

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PROUDLY PRESENTED BY:

## Overview

Protective coatings are used across a multitude of industries including; construction, infrastructure, oil and gas and mining. Protective coatings are universal in their applications, can be budget sensitive and an extremely effective approach to controlling and preventing corrosion. The longevity of protective coatings varies enormously with modern coatings capable of providing very high levels of corrosion protection, value for money and durability even in the most extreme environments.

This event will bring industry experts together to share their knowledge and investigate ways to better improve the longevity of protective coatings in a variety of applications and environments. The aim is to explore the protective coatings industry by looking at case studies, new technologies, environmental considerations, industry qualifications, standards and training and where possible reflect on how coatings can assist in a challenged economy.

**For further information and to register visit www.corrosion.com.au**

# MEET THE ACA BRANCH SECRETARIES

**Lucas Cashmere**

*Bureau Veritas – Asset Integrity and Reliability Services*

*Structural Engineer*

**Newcastle Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

On a day to day basis I assist clients with the asset management of infrastructure at several mining and product handling sites. This involves structural integrity inspections and associated non-destructive testing to identify areas of deterioration. Following the inspections, we provide remedial recommendations to ensure that the structures are returned to a serviceable state. Corrosion is often a mechanism of deterioration due to location and the products that are handled on these sites. Having a network of corrosion professionals allows me to tap into resources to best address corrosion issues and prevent reoccurrence.

***How long have you been volunteering for the ACA?***

I have been with the ACA for about one year.

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

Being involved with the ACA allows me to connect with corrosion professionals, to broaden my understanding of corrosion, preventative and remedial techniques to better advise my clients on how to best manage their plant. Additionally, I can forward clients on to specific professionals who may be able to best address their corrosion issues.

***What do you hope to achieve in your term as Branch Secretary?***

I am hoping to build on my professional network, learn and enjoy the experience.

**Dr. Gilles Dour**

*Advisian*
*Materials and Corrosion consulting branch*

*Principal Integrity Engineer*

**WA Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

Day to day work consists of materials selection, inspection plans based on Risk Based Inspection methods and identifying Integrity Operating Windows to monitor and control corrosion, which is applied most of the time to Oil & Gas applications. Asset integrity also involves looking at better ways to undertake inspection, using NDT techniques, managing data and developing work-scope optimisation tools. This can be the case for piping inspections for instance.

***How long have you been volunteering for the ACA?***

A few months.

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

Although not a member or volunteer for very long, I have been attending the WA branch technical events for the last 3 years on a regular basis. It is a good occasion to learn more, open your mind to new ideas and tools and meet people.

***What do you hope to achieve in your term as Branch Secretary?***

To do my best to be helpful to the ACA.

# MEET THE ACA BRANCH SECRETARIES

**Jim Galanos**

*Corrosion Control Engineering (NSW) Pty Ltd.*

*Engineering Manager*

**NSW Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

I am Engineering Manager for CCE's New South Wales operation where I manage a team of three corrosion engineers, eleven technicians and two admin staff. CCE's core business is Cathodic Protection (CP) and my role is to oversee and coordinate the company's engineering and field services group. Most of our day to day work involves CP design, installation, commissioning, monitoring and auditing for all types of buried or immersed metallic structures, as well as routine pipeline surveys and patrols. I also assist with tender submissions and estimating.

My responsibility as CCE's Engineering Manager, and as a NACE certified CP Specialist, is to ensure our customer's critical assets and infrastructure are protected from the destructive effects of corrosion for many years to come.

***How long have you been volunteering for the ACA?***

I started as a NSW Branch committee member in 2000 and have held the roles of President and Secretary.

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

I think it starts with understanding the significance of the role that we, as corrosion engineers, play and recognising the importance of what we do. I realise that in my role, I am responsible for the safety and integrity of some of Australia's most critical infrastructure and assets.

As someone who has been involved in the corrosion prevention industry for over 20 years, I take great pride in my work by providing cost effective solutions to our client's corrosion problems.

Being an active member of the ACA keeps me in touch with what's happening in our industry and allows me to meet like-minded individuals, both professionally and personally.

***What do you hope to achieve in your term as Branch Secretary?***

I work closely with the committee and head office to promote national branch events, training courses and our annual conference. Providing the membership with good information, service and value is of great importance to me.

**Aaron Harland**

*Industrial Galvanizers Australia*

*Operations Manager*

**TAS Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

I have been employed by Industrial Galvanizers Australia for the past 25 years, and have worked in galvanizing facilities in Newcastle NSW, Perth Western Australia, Campbellfield VIC and Launceston Tasmania as the Operations Manager. I am responsible for ensuring that the site produces a high quality galvanized coating finish to all products. This guarantees that the required coating provides the longest duration to first maintenance that zinc coatings offers, prior to being released to the asset owner.

***How long have you been volunteering for the ACA?***

I have been a volunteer with the ACA since I relocated to Tasmania 6 year ago and have been the branch secretary/ treasurer for the past two years.

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

The ACA has been an instrumental driver in supporting my role in the Coatings Industry. The ACA has enabled me to grow new personal and professional relationships through its networking events and Trade shows.

***What do you hope to achieve in your term as Branch Secretary?***

The role of branch secretary has allowed me to understand what the ACA is about, while providing valuable support through technical information for our members. This role will also ensure that my corrosion knowledge is not only in galvanized protection but other corrosion prevention products to help service my customers better.

**Dennis Richards**

*DMRichards Consulting*

*Principle Consultant*

**SA Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

I operate a technical consultancy, providing specialist services to local, State and Australian Government and private entities. The primary activities are the inspection and condition assessment of structures, inventory development and Asset Management Planning, with a focus on corrosion management. I am also a member of a number of Standards Australia committees, primarily in relation to coatings and corrosion, and am lead writer for the current review of the Hazardous Paint Management Standards.

***How long have you been volunteering for the ACA?***

I have been a member of the ACA since 1982, and a member of the SA Branch committee since 1992, filling the roles of SA Branch committee member, Secretary and President on many occasions. I held the position of Technical Chairman for the 2002 Adelaide conference and was Conference Convener for the 2010 conference.

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

I have been involved with the ACA for most of my working life; like many members, I enjoy not only the technical advantages of being in the Association, but also the social aspects of Branch activities. I expect that I will remain an active member of the ACA, with no planned exit strategy for the foreseeable future.

***What do you hope to achieve in your term as Branch Secretary?***

I will provide secretarial support to the Committee in their quest to deliver an informative and enjoyable technical program and to ensure that all goals of the Strategic Plan are implemented.

**Patricia Shaw**

*Callaghan Innovation*

*Principal Scientist*

**New Zealand Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

I have been a scientist (more recently a team leader) in research organisations for over 20 years. My roles have included applied research and the provision of technical advice in materials science, including corrosion and protective coatings.

***How long have you been volunteering for the ACA?***

About 4 years.

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

The ACA provides great networking opportunities, both within New Zealand and internationally. I have had great support from other ACA members as my career has developed. I enjoy staying in touch with current research through the conferences.

***What do you hope to achieve in your term as Branch Secretary?***

I enjoy supporting an active New Zealand Branch, which does a great job nurturing and educating the corrosion industry in New Zealand.

**If you are interested in joining an ACA Branch, contact the ACA on +61 3 98904833 or email aca@corrosion.com.au**

# MEET THE ACA BRANCH SECRETARIES

**Wayne Thomson**

*Anode Engineering*

*Engineering manager*

**QLD Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

My role is to include the corrosion prevention discipline into the wider asset integrity management strategy. I specialise in sales and marketing of specialist engineering technology and services to achieve commercially sound asset performance.

***How long have you been volunteering for the ACA?***

7 years

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

I gain a great deal of professional, technical and skill development value out of being an ACA member. I also enjoy the networking and fellowship the ACA offers.

***What do you hope to achieve in your term as Branch Secretary?***

I hope to contribute towards a sound functioning Queensland Branch and ensuring our members are aware of the value active involvement in the ACA brings.

**Adrian Vinnell**

*Aurecon Australasia*

*Materials Engineer*

**VIC Branch**

***Tell us about your day to day employment and how it relates to corrosion prevention?***

I work as part of a small team within a large engineering consulting company. Our team provides technical assistance across a range of corrosion related disciplines particularly cathodic protection, condition assessment, remediation strategies and protective coatings. My role as a materials engineer is quite varied and includes field and office based work across a range of industries.

***How long have you been volunteering for the ACA?***

I have been on the ACA committee for the last 4 years, and was previously chair of the Victoria branch YCG. I have been attending ACA events over the last 10 years.

***How does your involvement with the ACA help you to achieve your own personal and professional goals?***

The ACA provides plenty of opportunities to meet up with others in the industry, find out about projects that are underway and what techniques, products and tools are being used. There are always interesting people to meet and new skills to learn.

***What do you hope to achieve in your term as Branch Secretary?***

I hope to assist in running a range of events for the Victorian members covering an interesting cross section of the corrosion industry. I also hope to meet a lot of new members and see the Victorian branch continue to be active.

# Auckland Meeting

**June 2017**

An ACA Auckland meeting was held on the 28 June at The Landing hotel in Onehunga. Guest speaker at the mid-year dinner meeting was Mike Boardman, Director, Pacific Corrosion Consultants, a division of LTH Ltd, the umbrella company for specialist teams within the power engineering fields. Mike is a well-known member of ACANZ and he has served as the ACA Australasian President. His presentation was entitled: "It's not like watching paint dry", an account of his interesting career from a young seaman to being a well known figure in the Australasian world of corrosion control.

After an introduction by meeting Chairman Matt Vercoe, Mike started with an account of his early days as a young seaman in the UK, then a marine engineer, onto becoming a policeman in the Oman navy, then emigrating to NZ and becoming a specialist in ship marine coating systems. Then he moved into the power engineering field where he has specialised in corrosion control for the Transpower transmission tower network (28,000 towers) throughout the country. Mike described how their company carries out specialised condition monitoring on the galvanized steel towers and electric power lines using tower climbers, drones and helicopters. Many steel transmission towers are now old and require serious corrosion prevention measures such as fully painting the towers.

Mike then outlined his thoughts on the corrosion control industry, the cost of corrosion, and some technical and non-technical strategies that should be implemented to help minimise the huge cost of corrosion around the world. Following a Q&A session, many of the attendees enjoyed an excellent dinner and friendly ACA fellowship at The Landing restaurant. It was good to see that this meeting format attracted the attendance of a number of visitors and also several new ACA members.

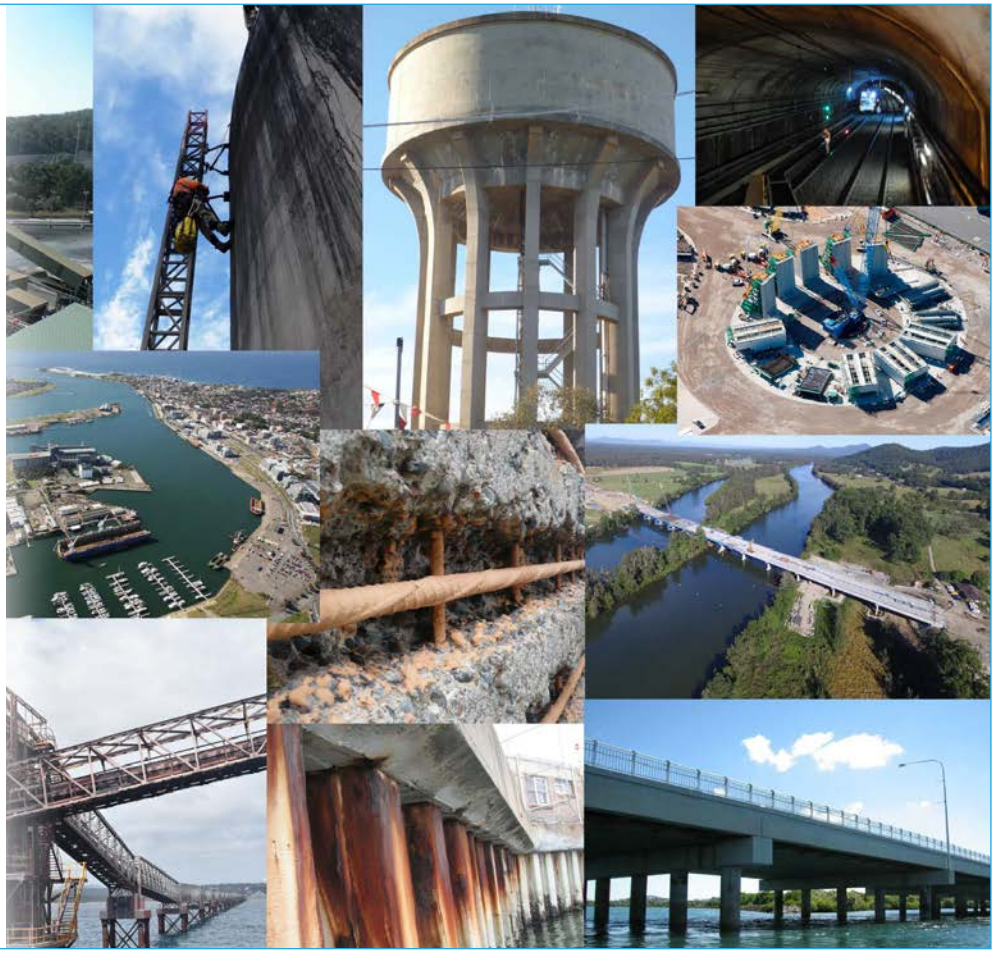
*Speaker Mike Boardman, PCC.*


*Young seaman Mike Boardman - 1973.*

*The audience at the meeting.*

*Dinner guests at The Landing Restaurant.*





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# Tasmania Branch Tech Event 1

**May 2017**

Members of the ACA Tasmania branch and guests met in Launceston on 11 May to enjoy a presentation from Ted Riding of Jotun.

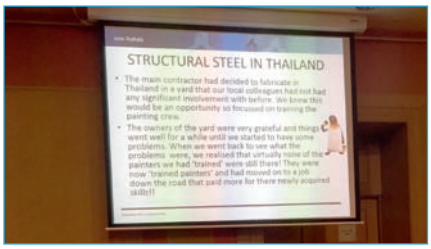
The topic was the learnings Jotun gained from their deep involvement in the coating project on the Newcastle Coal Infrastructure Group's ship loader. Ted's availability at short notice was seized by the branch and we had about 22 attendees.

Unlike most projects where the coating manufacturer is treated merely as a supplier, in this package Jotun were embedded as a contractor and had input into the decision making process within the project management team. It meant they carried a greater level of responsibility but also meant they had greater oversight on the day to day running. This meant that they could trap emerging problems in the process.

Although initially intended to be a local build, much of the fabrication and coating works were facilitated in Asia, enhancing the need for a clear specification and third party inspection.

The end result was good for all. Ted presented the topic and challenges in a very informative and entertaining manner. You should have been there!

*Dean Wall*




# Tasmania Branch Tech Event 2

The ACA Tasmanian Branch conducted another successful event in Ulverstone NW Tasmania on Wednesday 31 May with a Technical event presentation titled 'Bridge Maintenance, TGP Mainline Valve Sites & After Blast'

It was attended by over 30 members/non-members and was the second time the Branch had held an event at the Ulverstone Surf Club.

There were three very good presentations on the evening and the attendees said they looked forward to their next Branch event.

*Dean Wall*

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# NSW Branch / Brewery Tour

**June 2017**

On Thursday 29 June the evening began with a game of 'human bingo' where attendees asked each other a grid of questions trying to line up the answers. It was a fantastic networking opportunity where everyone got to talk to each other and prizes were awarded.

After human bingo, we began the tour led by our tour guide Jason. We learnt how beer was made and bottled. We got to taste the grain used in making beer as well as different types of beer including an unusual sour raspberry flavoured beer. The tour was fun, interactive and informal where attendees could ask as many questions as they liked.

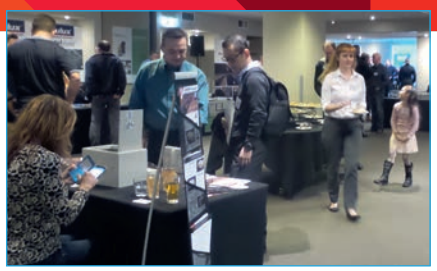
After the tour, our listening/memory skills were tested by a game of trivia based on information provided in the tour.

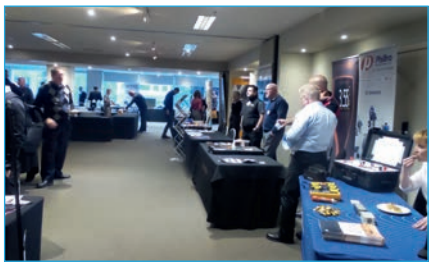
There was between 20 to 30 people attending with majority from the APGA. Unfortunately the only ACA attendees were from the sponsors (Denso and CCE) who happen to also be APGA members. Overall the event was fantastic, however it was disappointing, that more ACA YCG'ers did not attend. Here is to next time!

*David Sunjaya*

# 2017 CORROSION TRADE SHOW VICTORIA

On Wednesday 12 July approximately 100 people from the corrosion industry gathered for the annual ACA VIC Branch Trade Show. Consultants, contractors, materials suppliers and asset owners alike turned out for the event. With 22 exhibitors, flowing drinks and plates of delicious food the night was a great success. The show was open for three hours and many new connections were made, as well as some old ones being strengthened. Don't worry if you missed out, the Trade Show is held annually in July in Melbourne, Sydney and Hobart. Hope to see you there next year! *Candice Blackney*





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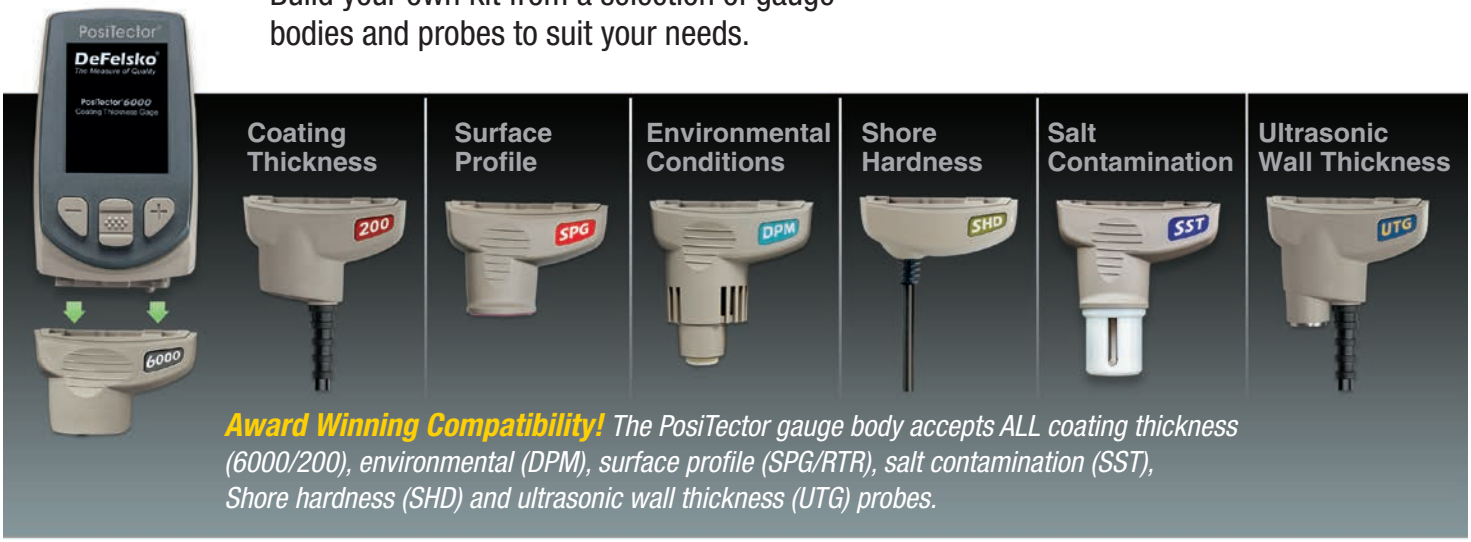
Build your own kit from a selection of gauge bodies and probes to suit your needs.

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# NEWS FROM THE ACA FOUNDATION

Many of us find that it is hard to pause long enough to reflect on the achievements of the past. There is always one more report to be written and email to be answered. We may even occasionally forget to acknowledge the contributions of those ACA members who had the vision to invest in future generations of the profession, with no immediate return to themselves. The Foundation knows that our work relies on the past and current support of ACA Branches, and on the individual members and companies who donate through the Scholarship and Centurion programs. The Foundation Board sincerely thanks you!

Many ACA members reading this column have direct personal experience of the benefits of an ACA Scholarship or have been lucky enough to attend one of the Foundation's Future Leaders Forums. Since 2012, the Foundation has awarded over 50 Scholarships and offered 60 places in Future Leaders Forums [FLF]. Scholarships have enabled participation at international conferences and associated study tours; attendance at ACA C&P Conferences for first time and post-graduate attendees; as well as registrations for the highly regarded corrosion training courses offered through the ACA. ACA members and the Foundation can be justly proud of this achievement. All scholarship reports have been published in this journal for the interest and information of members. In the words of the ACA Board Chairman, Dean Wall, "I can say with confidence that the Foundation is a valued member of the ACA family. Through its Scholarship Program, the Foundation contributes to the skills and knowledge of the corrosion science, engineering and technical workforce. The Foundation also reaches out to the next generation of corrosion practitioners through its Secondary Schools Resources Project. The Foundation plays a valuable role in realising the ACA vision of managing corrosion sustainably and cost effectively to ensure the health and safety of the community and protection of the environment. In short, I encourage all ACA members to continue their support of the Foundation which enriches the work of the ACA and its overall contribution to the community."

The next step for the Foundation is to build an active alumni group amongst both Scholarship recipients and Future Leaders Forum attendees, and to enlist their assistance in guaranteeing the longevity of the Scholarship and FLF Programs which lie at the heart of the Foundation's work. We will have more information about this new development in the next issue of *C&M* and on the Foundation website.

Our community outreach activities are also gathering pace and members will be able to locate excellent teacher and student resources, written to the latest curriculum standards for years 9 & 10, on the Foundation website.

As well as this regular column in *C&M*, please stay in touch with all of the Foundation's news by subscribing to our website https://foundation.corrosion.com.au/

*Linda Lawrie*, Executive Officer, ACA Foundation

## Message of thanks to ACA Branches from Warren Green, Chair, ACA Foundation Board

My sincere thanks to those ACA Branches which have responded generously to the Foundation's request for financial assistance to build its management capacity. Your support is highly valued by the Board and enables us to continue the Foundation's work while also focussing our efforts on building a financially stable future.

## Stay connected with Foundation News through our regular blogs

**Join the Foundation website blog for all of the latest news including key dates for scholarships and events. Go to https://foundation.corrosion.com.au/ and scroll to the bottom of the page to find the subscribe button. All you have to do is enter your email address and click on 'subscribe'.**

## NEW!

## An evening of fun at the Foundation's fundraising event at C&P 2017 Conference

All attendees at C&P 2017 are welcome to join us for the ACA Foundation fundraising event on the evening of 13 November. Purchase your tickets when registering for the Conference and enjoy an evening of fun with DJ, deluxe beverages, premium canapes and the chance to catch up with friends and colleagues in a relaxed and welcoming environment.

Located upstairs at the Watershed Hotel, Darling Harbour, Cohibar Lounge and Terrace offer panoramic views encompassing the city skyline and Cockle Bay. You can have a great evening of conversation, food, drinks and music and contribute to the Foundation's fundraising at the same time. More information available at https://conference.corrosion.com.au/registration-fees-and-information/

## Welcome to new Foundation Board Director

The Foundation Board welcomes the appointment of Christine Crawshaw as a new Board Director. Christine works for Transurban as a Senior Business Advisor – Operational Excellence Team. She has been working in the Asset Management industry for 10 years in various roles including project management, consulting, leadership and coaching. Outside of work, Christine is currently completing her MBA studies at Melbourne Business School. The Board looks forward to Christine's valuable contribution.

ACA Foundation Scholarship Fund Centurions make a tax deductible annual donation of AUD$100 or more, to the ACA Foundation Scholarship Fund. This Fund provides money for scholarships, bursaries and prizes.

ACA FOUNDATION LIMITED CENTURION DONOR

Find out how you can renew your Centurion membership, or join the Centurions as a new member, on our website.

https://foundation.corrosion.com.au/who-is-an-aca-foundation-ltd-scholarship-fund-centurion/

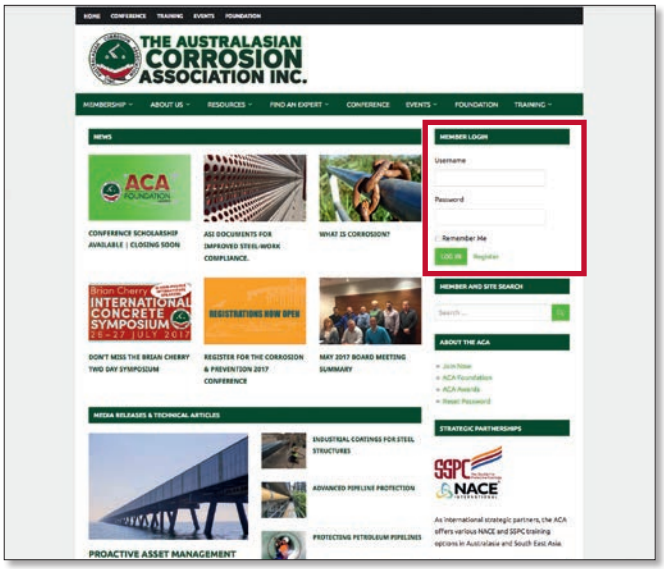
**To learn more about the Centurions, please call the ACA Executive Officer, Linda Lawrie, Tel +61 3 9890 4833.**

# Members - Have you logged in to the new ACA website to update your details and access 'Member Only' information yet?

## It's really simple! Do it today if you haven't already.

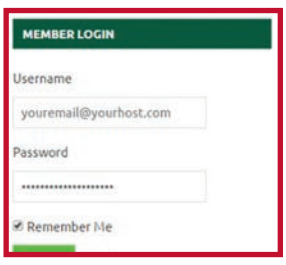
## It will take 5 mins!

- Use your email address in the 'Get New Password' email window, to send yourself the 'reset link'
- Check your email (if you can't find it; check your spam folders)
- Click the password 'reset link' at the bottom of that email and you will be directed to a password reset page on this site.
- Please ensure you are using a recent email as the link only lasts 24 hours.
- The system will generate a strong password for you but you do not have to use it.
- You have now reset your password. Gold Star!




## Logging in to the Website


- Click the ACA Logo at the top to return to the front page
- On the right hand side of the site you will see this box →
- Use your email as your Username
- Use your new password
- Click Remember me
- Click LOG IN




- Once logged in the front page will change to the current member content
- Please bookmark your membership site as the content changes all the time with new:

– Video
– Technical Articles
– Conference Papers
– Branch News & more.

**Remember — You DO NOT need to log in to book an event or training!**

# Professional Recognition for Applicators Now Available

SSPC *TrainthePainter* is a globally recognised qualification, now available through International Paint in Australasia and worldwide regions.

SSPC Society for Protective Coatings was founded in 1950, as a professional organisation focused on the use of protective coatings for asset preservation, global standards and authoritative recognised industry training.

SSPC *TrainthePainter* offers the professional recognition and proof of verified skillset that protective coatings applicators deserve, without ties to local or national government bodies and organisations. Applicators and their employers working with global asset owners, projects and specifications, will be able to use this professional training standard as leverage in their business dealings locally, nationally and worldwide.

The course is specific to protective coatings blasting and application professionals, delivered by SSPC-approved, highly skilled and experienced International Paint staff. The unique partnership between SSPC and International Paint AkzoNobel, has been rolled out worldwide to deliver all *TrainthePainter* packages. This collaboration results in a quality and credibly delivered program that further emphasises a must-have qualification.

Within Australasia, *Silver Level Protective Coatings Application Spray Painting* qualification is now available with upcoming training sessions in Brisbane 19-20 September and Perth 17-18 October. Training in other states will be available from 2018.

Opportunity for in-house applicator company courses is also available by request.

The Silver Level is a comprehensive two-day course covering theory and practical components of coatings and corrosion technology, equipment technology, methodology and use. Assessable criteria to receive the qualification ensure only experienced, competent applicators may earn the right to the recognition and credibility the qualification offers.

**For all SSPC *TrainthePainter* enquiries please email TrainingANZP@akzonobel.com or call the International Paint Technical Service Team on +61 7 3727 5100.**

International

# Promoting professionalism, safety and efficiency within the coatings industry

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# ACA Standards Update Summary*

**Welcome to the corrosion related standards report for August 2017.**
The standards reporting for 2017 is scheduled against specific interests and as indicated below:

| Issue 2017 | Standards search for Specific Interests |
|---|---|
| **February** | Oil & Gas |
| **May** | Asset Management |
| **August** | Protective Coatings |
| **November** | Concrete & CP |

This Standards report focuses on Protective Coatings in relation to corrosion.

As previously this is in two stages, namely:

1. A global standards and publication focus at **10 July 2017**, searching through SAIGLOBAL Publications at https://infostore.saiglobal.com/en-au/Search/Standard/?sortKey=productName-asc&productFamily=STANDARD , for all current publications and standards relating to corrosion and its prevention for the topic of 'Protective Coatings' with a focus on corrosion.

These results are shown in Table 1.

2. A SAI Global search at https://infostore.saiglobal.com/en-au/Search/Standard/?sortKey=productName-asc&productFamily=STANDARD, with filters set as below,


for new standards, amendments or drafts for AS, AS/NZS, EN, ANSI, ASTM, BSI, DIN, ETSI, JSA, NSAI and standards and amendments for ISO & IEC published from **19 April - 10 July** 2017, using the key words and key word groups:

- 'durability'.
- 'corrosion' or 'corrosivity' or 'corrosive'; but not 'anodizing' or 'anodize(d)'.
- 'paint' or 'coating'; but not 'anodizing' or 'anodize(d)'.
- 'galvanize' or 'galvanized' or galvanizing'.
- 'electrochemical' or 'electrolysis' or 'electroplated' or anodizing' or 'anodize(d)'.
- 'cathode' or 'cathodic'.
- 'anode' or 'anodic'.
- 'corrosion' and 'concrete' or 'concrete' and 'coatings'.

These results are shown in Table 2.

## Summary

1. Through SAIGLOBAL Publications for a search on 'paint or coating', with a focus on corrosion, there was a total of 648 citations with 47 AS and NZS citations, with 46 standards and 1 draft.

There were 21 ASTM, 15 ISO and 9 NACE citations.

2. Across SAIGLOBAL online Standards Publications there was a total of 40 listings of new standards, Drafts and Amendments found that were issued from **19 April–10 July 2017**; 7 from AS AS/NZS as shown below;

a) AS/NZS IEC 60754.2:2017 Test on gases evolved during combustion of materials from cables Determination of acidity (by pH measurement) and conductivity

b) AS/NZS 60335.2.13:2017 Household and similar electrical appliances - Safety Particular requirements for deep fat fryers, frying pans and similar appliances

c) AS/NZS 60335.2.97:2017 Household and similar electrical appliances - Safety Particular requirements for drives for shutters, awnings, blinds and similar equipment

d) AS/NZS 60335.2.79:2017 Household and similar electrical appliances - Safety Particular requirements for high pressure cleaners and steam cleaners

e) AS/NZS 60335.2.29:2017 Household and similar electrical appliances - Safety Particular requirements for battery chargers (IEC 60335-2-29 Ed 5, MOD)

f) AS 2809.4:2017 Road tank vehicles for dangerous goods Tankers for toxic and corrosive cargoes

g) AS 1289.4.4.1:2017 Methods of testing soils for engineering purposes. Soil chemical tests - Determination of the electrical resistivity of a soil - Method for fine granular materials

All results are shown in Table 2 in the full report for Members via Resources/**www.corrosion.com.au**.

Regards

Arthur Austin
(Arthur.Austin@alsglobal.com)

***For the full Standards Report, please visit www.corrosion.com.au**

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**Thursday 11 May 2017 | Auckland**

# How to protect New Zealand infrastructure from the worst effects of corrosion

Asset managers and corrosion experts across New Zealand gathered in Auckland recently to share experiences and the latest information on how corrosion impacts assets. The one-day seminar was presented by ACANZ, the Australasian Corrosion Association's New Zealand Branch, and sponsored by Carboline NZ. It was titled 'Protecting New Zealand Infrastructure.'

A discussion on how to best get this message across to asset owners included the case made by Dr Jonathan Morris of Opus International Consultants, who pointed out that engineers need to use plain English to explain the costs and benefits of having an effective protection plan for assets.

One example could be of a galvanized boat trailer to demonstrate the benefits of maintenance washing – citing the increased life of the trailer when it's regularly and thoroughly washed.

**Once risks are identified, asset owners need to manage these in a timely way.**

Liam Coleman of the Auckland Motorway Alliance shared his experiences of managing older bridges in the UK and Ireland and rail links across the world, and how careful monitoring of the asset can manage risk until funds are available to fully repair or replace it.

Many participants agreed that a design life of, say, 50 years (as is the case with residential builds including apartments) or 100 years (for major infrastructure) is often expected to perform considerably beyond that. Many road and rail bridges built in the late 19th century are still operational and expected to carry increasingly large loads.

One such structure in Auckland is the old Mangere Bridge spanning the upper Manukau Harbour. At the moment, it is used for pedestrian traffic only and serves as a recreational asset linking the Mangere and Onehunga communities. However, the structure is significantly corroded and will continue to deteriorate.

A replacement pedestrian bridge is in the consenting process, but could still be up to three years away. The existing bridge therefore needs to safely remain open until that time if possible.

The most deteriorated spans have been fenced off, and physical bracing has been installed to manage the risk and increase safety factors. Real time monitoring in the form of 100 sensors is in place, alerting engineers immediately if stresses exceed the agreed stringent levels.

With the decrease in "hazardous" anti-fouling coatings, microbial-induced corrosion (MIC) is increasing in ports




throughout the world. It's now also being seen in fresh water, such as in the corroding sheet pile diversion wall in Lake Rotoiti. This wall must divert the inflow from Lake Rotorua into the Kaituna River until 2057, so options delivered to the client included structural strengthening, use of an impermeable polymeric screen, or complete removal and replacement of the wall with vinyl sheet piles.

ACANZ President Raed El Sarraf from Opus was able to discuss the various advantages and disadvantages of each system with the client, who could then make an informed decision on the risks of each balanced against its relevant cost and maintenance requirements.

Les Boulton, a leading materials and corrosion consultant, believes that the leaky buildings issue will continue for at least another 20 years, as a result of the design fashion begun approximately 20 years ago of building "Mediterranean-look" housing where claddings were fixed directly to timber framing using metal fixings. No air gaps or damp proof courses meant water was able to reach insulation and interior wall linings, allowing dangerous mould to grow and rot to develop.

While such designs met the NZ Building Code and gained certificates of code compliance, the serious corrosion issues they engendered have meant repairing the resultant damage can cost up to twice the original purchase price.

Dr Patricia Shaw subsequently spoke of BRANZ's work in updating the New Zealand Corrosivity Map, which rates exposure risk to structures based on long term field testing of a range of materials. Early indications suggest that more sites and finer measurements delivered by the current research are changing the risk profile for many geographic areas. BRANZ has also found that many materials display "unusual" corrosion behaviour within geothermal environments.

**The correct protection methods for New Zealand structures are therefore very important.**
The best protective coating is often more expensive to apply but will also extend the "time to first maintenance" period, and appropriate maintenance after that will ensure the asset's integrity. Matthew Vercoe of Metal Spray Suppliers explained how a good specification can help contractors apply the coating correctly, as well as help owners to understand the benefits of initially spending a little more.

Regular inspection and testing of the protection ensures the underlying material is able to maintain its integrity at least until the end of its design life.

Phill Dravitski is qualified to inspect the state of protective coatings in New Zealand and he does a lot of work with Transpower NZ, climbing the transmission towers to physically check their surface coatings. He points out that protective treatments change depending on the site, the previous coating used, how long ago it was applied, and the skill of the coating applicator.

It's important that an independent third party physically inspects all of a tower by climbing and examining it for signs of corrosion as drones will miss too much, in his opinion. And despite a check plan, he finds that personal perception of compliance when re-applying a protective coating isn't necessarily the same as true compliance.

Representing Seminar sponsor Carboline, Neil Adamson discussed the effects of concrete degradation and subsequent rebar corrosion, especially as demonstrated in wastewater treatment plants and chemical bunds.

Sub-surface defects in concrete finishes can affect the performance of protective coatings, he explained, and with the increase in unvented hydrogen sulphide, MIC levels are also increasing in enclosed systems such as wastewater pipes and tanks. 30ppm of $H_2S$ will cause severe concrete corrosion, and anecdotally this has increased to over 100ppm in some systems internationally. Asset managers cannot vent $H_2S$ from treatment plants today because nearby residents don't want the smell, consequently trapping more sulphides than ever and placing more demand upon protective coatings.

Seminar Chairman Willie Mandeno then summed up the seminar presentations and chaired a Forum session. There were many questions from the audience and many helpful responses given by the speakers.

The seminar was wrapped up with an invitation to participate in a networking drinks session held in the Exhibition hall.

*Article by Corrie Cook*



# Corrosion in Non-Conventional Oil & Gas

PROUDLY PRESENTED BY: AUSTRALASIAN CORROSION ASSOCIATION INC.

SPONSORED BY: ANTICORROSION TECHNOLOGY, STOPAQ A SEALFORLIFE COMPANY, International

## The Gabba, Brisbane 23 May 2017

The 2017 ACA Oil & Gas Technical Group Symposium was held amidst the spectacular backdrop of the famous Gabba sports arena. Forty six attendees gathered to hear expert speakers from industry and academia discuss a range of topics critical to asset preservation in the non-conventional oil & gas field.

Oil & Gas Technical Group Chairman, Dr Fikry Barouky and Secretary Mr Phil Fleming welcomed the gathering and delivered an update on the activities of the ACA Oil & Gas Technical Group including progress on the Technical Group's leading project to develop a best practice guidance for control of corrosion under insulation (CUI) in the oil and gas industry.

First speaker, Wayne Thompson from Anode Engineering gave a comprehensive review of methods of mitigating corrosion on shore based riser pipes. The riser pipe connects sub surface production to surface process equipment and is especially prone to corrosion at the point where the riser penetrates soil. Wayne discussed how different soils influence electrolyte composition around pipe and therefore affect corrosion rate or efficacy of cathodic protection.

Tape wrapping and other types of mechanical barriers can be used at the air/soil interface to prevent surface corrosion. Barrier use raises issues in practice, for example mechanical barriers may be damaged/compromised and the transition or tie in to the pipeline coating is important. Electrical isolation of risers from surface structures using engineered glands, flange isolation is also an important method of controlling current flow and hence corrosion.

Wayne emphasized the need to understand soil resistivity for effective CP control and how it is important to extract a variety of samples from the field to get an idea of corrosion potential of soil.

Practical aspects such as design of pipe supports/saddles to minimise accumulation of dirt etc which may compromise pipe life especially if coating was damaged, were also covered by Wayne.

Our next speaker Geoffrey Will of Queensland University of Technology gave a very interesting account of flow assisted corrosion (FAC) in produced water from coal seam gas (CSG).

There are over 15000 CSG wells in Australia – at various stages of age and output and wellhead corrosion of steel pipes is a significant issue and fluid velocities are hard to pin down. The pipelines carry mixed gas/liquid/solid phases. It is estimated that 25% of failures are corrosion related and 15% of these failures are due to flow assisted corrosion (FAC). This type of corrosion is not restricted to wellheads and one of the CSG operators present commented that similar corrosion is also found downstream from wellheads.

$CO_2$ and $H_2S$ are significant problems elsewhere but there is no $CO_2$ or $H_2S$ in Queensland CSG waters. The alkaline nature of the waters means that most of the $CO_2$ is present as bicarbonate – this reacts with iron on the pipe wall to form iron carbonate (siderite). The odd scalloping effect observed in CSG flowlines appears to be linked to formation and removal of siderite. Occurrence of this effect on bends or welds indicates turbulence is involved. Corrosion rate increases as flow increases.

Fikry Barouky.

Phil Fleming.

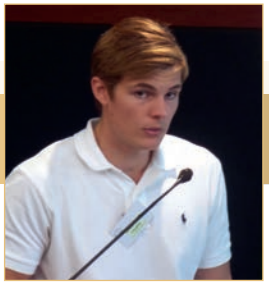
The Gabba.

Geoffrey explained the investigation methods used by his group. Laboratory work using a rotating disc electrode and flow loop were used to establish corrosion rates whilst ultrasonics were used to extend the understanding of these complex, flow related systems. They found that whilst increased flow rates can condition the surface and build up carbonate scale, the microstructure of the scale may be such as not to protect surface from corrosion. Oxide film thickness builds but corrosion rate increases. Finally the effect of a novel inhibitor was described – Ipomoea batatas leaf extract (from sweet potato leaf) was effective as a corrosion inhibitor for mild steel in HCl in a laboratory study.

Stephen Challis from Viva Energy Geelong Refinery gave on overview of the benefits of electromagnetic acoustic transponder (EMAT) technology for piping inspection.

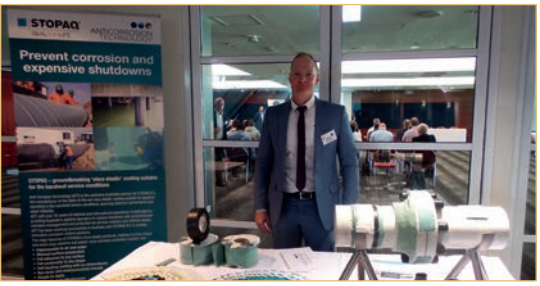
Like other UT techniques EMAT creates ultrasound waves in the material

Wayne Thompson.



Stephen Challis.

The Speakers.




Anti-Corrosion Technology Sponsor.

being inspected and the presence of corrosion or defects shows up as an attenuation of the signal with reduction in signal amplitude proportional to corrosion thickness.

Geelong Refinery use EMAT as part of an integrity management strategy to ensure dependability of the refinery, maximise use of the assets and support Viva's social licence to operate by ensuring the safety of the site.

Benefits to the refinery from use of EMAT include its ability to detect hidden corrosion, speed of use, no couplant required, ability to maintain signal with limiting surface conditions such as wet, oily, rough, oxidised as well as being useful for scanning materials operating at high temperatures.

Stephen demonstrated the value of EMAT by describing case studies including detection of shielded corrosion and corrosion under pipe supports as well as pipe corrosion at a soil/air interface. In these cases the early detection of corrosion meant that the refinery was able to plan the isolation and repair of the parts thus minimizing disruption and ensuring safe operation of the refinery.

Dr Fikry Barouky of Anti Corrosion Technology spoke on Corrosion Management in Oil & Gas – is it "strategic" or "tactical"?

Fikry challenged the audience to consider whether corrosion control should be "strategic", i.e. aimed at minimising corrosion and its associated costs through a risk based, proactive approach or "tactical" where techniques such as protective technologies, corrosion allowances and equipment replacement form the basis of a predictive or condition based maintenance approach. The correct selection of strategy requires an accurate assessment of the total cost of corrosion throughout the life cycle of an asset combined with a realistic view of the total cost (financial, environmental, human and otherwise) of asset failure.

In a nutshell, the difference between strategy and tactics comes down to selecting between an overall, holistic approach versus activity to "put out fires" along the way.

Due to their critical nature, effective protection of oil and gas assets often requires a combination of these approaches and so corrosion control activity becomes an interrelated matrix of systems, teams, tools and operational data. Effective corrosion control strategies require management of available resources, finance, materials, equipment and manpower as well as policies for the implementation of the strategy. On the other hand the effectiveness of the tactical approach depends on the successful deployment of methodology to control corrosion.

Fikry concluded by discussing corrosion management in the operational phase of projects. Examples included discussion of $H_2$ induced cracking leading to pipe failure and concrete failure due to rebar corrosion in chloride containing environments. Understanding of the "bath tub curve" which relates failure rate to age of items can guide risk assessment and strategies eg accept that corrosion damage will occur but increase inspection frequency. Other examples stressed importance of risk avoidance strategies such as prevention of collapsed legs on gas spheres resulting from corrosion under insulation whilst cathodic disbondment (CD) testing of self-healing coatings was described as part of a tactical approach.

Ivi Cicak from the National Facility for Pipeline Coating Assessment (NFPCA) at Deakin University presented on Developing New Coating Testing Methods to Meet Growing Industry Needs.

Ivi explained how NFPCA offers a range of NATA accredited tests for pipelines and coatings and went on to describe some of the tests of particular relevance to the oil and gas industry.

For example the methods for cathodic disbondment resistance (CDR) testing were discussed and factors which influence the tests considered, especially testing of coatings at high temperature.

Work is also done at NFPCA to investigate the real work ability of tests as a predictor of coatings failure and to identify improvements and modifications to equipment. Gouge resistance testing was an example of this as well as a very interesting study on pipeline bending: flexibility testing. It was noticed that variation in mandrel size especially small diameter mandrels gave stress concentration in the centre of the coupon which gave misleading results. Strain gauge studies overseas led to use of end clamps but NFPCA identified that use of centre clamps gave best results.

Another interesting example was stress corrosion cracking of X65 pipeline steels. In this study using an electrochemical cell, samples were cycled for 10 days and inspected for cracks. Mill scale cracks are a means for corrodant ingress and pits form below cracks. Grit blasted pipes remove mill scale but stresses to the surface and change in grain structure occur. Microstructure plays part in improving corrosion resistance of surface.

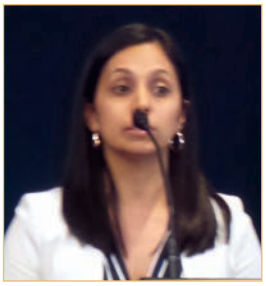
Matthew O'Keefe of International Paints spoke on Advances in Lining Technologies for Land based Steel Storage Tanks.

He outlined the reasons why tanks are lined which include corrosion protection, protecting of product purity and for maintenance of steel integrity. An example of the latter is ethanol which may cause stress corrosion cracking (SCC) of tank welds. API 652 and 653 contain recommendations and standards for lining of land based storage tanks.

When tanks are dedicated to a specific product, selection of linings is often straightforward. It is when the lining needs to cope with a variety of cargoes that problems often arise. As well as providing protection from corrosion the effect of linings on contamination of stored cargoes must be considered.

As well as the consideration of lining selection for variable vs. dedicated cargo storage, other factors such as heating coils may need to be taken into account in the selection decision. All of these factors contribute to the cost of the coating system.

Matthew O'Keefe



Silvia Chaparro.

Nestor Sequera.

Speakers and Seminar Delegates.

Matthew described the importance of steel condition and pitting as a key factor in determining coating thickness. He gave an example where reinforced epoxy linings applied at 1,000 micron thickness can be used as alternative to tank floor plate replacement in pitted steel.

The presentation included a detailed description of how tank lining epoxy coating performance is influenced by resin type, cross link density and curing agent selection. The degree of cross linking is especially important in ensuring the integrity of the lining at elevated temperatures. Whilst all epoxies of various degrees of cross linking will stop water permeation at room temperature, at high temperatures water will permeate and coating will fails unless it is highly cross linked. Case studies of linings successfully used for produced water storage at 88-94 deg C and in a deionizer vessel operated at 100-107 deg C served to demonstrate the effectiveness of this approach.

Our penultimate speaker, Silvia Chaparro, is a biologist at the Corrosion Engineering Industry Centre at Curtin University and her presentation was entitled Assessing the Risk of Microbially Induced Corrosion (MIC) and its Treatment.

It has been reported that MIC accounts for 40% of all corrosion in the oil and gas industry and 70% of corrosion in gas transmission.

Microbial adhesion and biofilm formation are the basic mechanisms for microbe attachment along with the excretion of "extracellular polymeric substances" (EPS). Like all corrosion the mechanisms of MIC include electrochemical processes but the versatility of microorganisms to cause corrosion is impressive. Mechanisms includes "nano wires" and direct consumption of electrons from steel to provide an energy source for organisms. The organisms can also produce corrosive metabolites. Likewise the role of a range of causative organisms was discussed e.g. sulfate reducing bacteria (SRB), sulfide producing microbes (SPM), acid producing bacteria (APB) etc.

Reference was made to the NACE test method 'Field monitoring of microbial growth in oil & gas systems'. Organisms need to be cultured and identified, as well as assessing whether they are they active or dormant – tasks involving molecular biology and microscopy.

An area of considerable practical interest in the oil & gas industry is how corrosion under deposits can be influenced by microbial activities. Tests show much higher corrosion rates in sand deposits spiked with bacteria under $CO_2$ conditions than the abiotic control (6.6 times greater).

The key to controlling MIC is to select or control the metabolic conditions. But this may not always be possible so resort to biocides is necessary. Some corrosion inhibitors may also exert a negative effect on biofilm formation depending on the organism community.

Our final speaker, Nestor Sequera of SN Integrity spoke on Deployment of Smart Corrosion Monitoring in Oil & Gas Facilities.

Nestor commenced by explaining that the trend in modern life is towards increased convenience and this is being facilitated more and more by the Internet of Things (IoT) – the ability of smart devices (phones, tablets, devices, gadgets, anything) to be globally connected. And data collection and dissemination is vital for corrosion control.

But first it is useful to consider the historical origins of corrosion monitoring - pipe gauging, tell tale holes, coupons, probes, meters, etc and how the shortcomings in each method has acted to spur on new developments.

For example corrosion coupons are simple and inexpensive but can give misleading results and can be a challenge to replace even if retractable. Accordingly this led to adoption of electrical resistance (ER) probes which whilst an improvement on coupons can suffer from a high infant mortality rate and can also be difficult to replace. Data generation by these methods was painfully slow.

The advent of ultrasonic thickness (UT) technology as a powerful and convenient method of monitoring corrosion has led to proliferation of thickness and corrosion monitoring locations (TMLs and CMLs) with consequent increased manpower and potential for lots of data generation – but the problem is how to manage the volume of data in a cost effective fashion.

Modern UT sensing systems with multiple sensor points connected via smart technology can provide the solution to these problems. Frequent ultrasonic measurements act to minimise variability whilst data collection frequency is the key to enhanced trending. Web based data management is an inherent feature of these systems as well as the ability to transmit alarms and warnings via e-mail. In addition savings in manpower and total cost per point can result.

The meeting concluded with a speakers forum which included a lively interchange of experiences and viewpoints between the audience and the speakers. Afterwards drinks and snacks with a view of the Gabba provided a relaxed opportunity for networking after a serious and productive day.

Thanks to Lucy, Tracey and Ross of ACA Melbourne for arranging the venue and for support on the day. Copies of the speaker's presentations are available on the ACA website.

**Fikry Barouky and Phil Fleming**

# CONCRETE 2017

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# Hertel Industrial Services

***Q: In what year was your company established?***

***A:*** The Company was founded in Western Australia in 1980 and operates Australia wide in the resources, infrastructure and building sectors.

***Q: How many employees did you employ when you first started the business?***

***A:*** When the Company was founded we had a core team of twelve employees.

***Q: How many do you currently employ?***

***A:*** Currently we have 50 core staff employees along with 750 site based employees and 22 workshop based employees.

As we are part of a multinational industrial services group operating in over 25 countries the total group workforce is over 13,000.

***Q: Do you operate from a number of locations in Australia?***

***A:*** Our Australian head office is in Perth, Western Australia and we operate special project offices Australia wide

***Q: What is your core business?***

***A:*** Hertel Industrial Services are a solutions based contractor specializing in Industrial Insulation installation (hot, cold, cryogenic and acoustic) primarily for LNG plants, Power Plants, Refineries, Process Plants, Offshore and Mine sites.

Other services offered are:

- Blasting and painting
- High performance protective coatings
- Passive fire protection
- Sheet metal & black steel fabrication
- HVAC Ductwork and Insulation
- Scaffolding
- Offshore Maintenance
- Operations support

***Q: What markets do you cover with your products or services?***

***A:*** We service a wide range of markets sectors including: Oil and Gas, Industrial, Mining, Marine and Commercial.

***Q: Is the business yard based, site based or both?***

***A:*** Hertel Industrial Services is both yard and site based, we have an office, insulation and metal fabrication workshop and storage facility in Western Australia covering 13,000 square metres.

Site based facilities include blasting and painting, insulation fabrication, sheet metal fabrication, passive fire protection as per project requirements.

***Q: What is the most satisfying project that you have completed in the past two years and why?***

***A:*** Hertel Industrial have recently successfully completed the Painting, Insulation and Fire Protection contract for the three LNG trains on the Chevron Gorgon LNG project, works were undertaken at both the Henderson Marine facility and on Barrow island.

The project included the pre-insulation of equipment at the Henderson Marine facility and the Blasting and Painting, Insulation and Passive Fire Protection completion works of piping and equipment on Barrow Island.

As Barrow Island is a Class A nature reserve all works were completed under strict environmental, safety and quarantine requirements along with onerous logistic requirements.

***Q: What positive advice can you pass on to the Coatings Group from that satisfying project or job?***

Executing a project of the size and complexity as Gorgon LNG involves ensuring that you have an experienced senior project team and supervision. To ensure a timely completion of the project the emphasis is on the Planning and Scheduling, Safety, Quality and the Management of the Logistics in addition to close communication with the client's project team in all aspects of the project. Ensuring the workers are fully trained in all aspects of their role in the project execution.

***Q: Do you have an internal training scheme or do you outsource training for your employees?***

***A:*** We conduct both internal and external training of all our employees to ensure that the safety of all our employees and others. Ensuring that they are all highly skilled, safety conscious and have avenues open for career opportunities.

We operate an In-House Training Database which includes skill, competency and induction management.

Employee training records are maintained and tracked to ensure all relevant training required is undertaken and is current ensuring the Company's skill base in increased and opportunities for advancement can be identified.

Training Matrix Reports are performed to identify skills required for employees in relation to jobs/tasks being performed.

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# PIPELINE CORROSION MANAGEMENT

## Thursday 29 June 2017 | Melbourne

Having previously been held in Brisbane and Perth over the last two years, the 'Pipeline Corrosion Management Seminar' came to Melbourne this year. The event is held annually in conjunction with the Australian Pipelines & Gas Association (APGA) and as such, highlights the importance of the two organisations working closely together to address what is becoming a bigger issue as our nation's pipeline infrastructure ages gracefully.

Around 90 pipeline and corrosion prevention industry professionals from all over Australia came together to discuss the real issues that corrosion currently presents to the pipeline industry. APA's East Coast Grid Engineering Manager, Craig Bonar kicked off proceedings with a keynote presentation highlighting some of the incidents and problems corrosion has caused in the pipeline industry worldwide, and he presented a clear message to the group that we must remain vigilant and pro-active when it comes to pipeline corrosion management.

The keynote was followed by presentations from other pipeline owners, integrity managers and regulators, as well as coatings, cathodic protection and NDT experts. The broad mixture of interesting topics also included an insight into the excellent work Deakin University is doing in pipeline coatings and complex CP research projects.

All of the presenters and delegates attending, to some degree, have either an interest in or a responsibility for, the safety and integrity of some of Australia's most critical infrastructure and assets, so this forum gave them the opportunity to learn from the experts and network with like-minded industry colleagues and professionals.

The ACA would like to thank both Corrosion Control Engineering and Denso for sponsoring this seminar and UCC Canusa for providing the well-received networking drinks function at the end of a very enjoyable and informative day.

*Seminar Chair and Presenters. From Left to Right: Judd McCann (Sonomatic), Ivi Cicak (Deakin), Peter Wade (ESV), Jim Galanos (CCE), Andrew Jones (Jemena), David Towns (Denso), Alan Bryson and Craig Bonar (both APA Group) and Jason Paterson (Chair, CCE).*

# Queensland University of Technology: Materials Degradation

At QUT corrosion has taken us to many interesting areas of materials research over the last 40 years. We feel that the initiation, type and rate of material degradation are the key features to understanding and controlling the process and as such have drawn on knowledge from the polymer, concrete and metals science and engineering area. Currently, our 10 member group comes from experts in polymer degradation, modelling, electrochemistry, corrosion and surface science. Our group has also been extremely well supported in our efforts by provision of the Central Analytical Research Facility (CARF) with cutting edge material characterisation capabilities and operators with research and industry expertise in a variety of areas including concrete, aluminium and water analysis.

QUT has always had a diverse range of interests in pure research such as modelling corrosion mechanisms to the more applied work with some of the 100 companies we have assisted on degradation related issues. QUT offers a pay for service testing and consulting option as well as collaborative research option for interaction with its research community. In the area of materials degradation we have experience in legal and expert witness cases and the majority of the work has been in the identification and remediation of metals and polymer coatings exposed to aggressive environments.

We utilise a suite of techniques from IR spectroscopy, hyper spectral imaging, X-ray analysis, electrochemistry and more traditional visible and electron microscopy to understand the cause, extent and solution for specific issues.

QUTs two main research projects in materials degradation are corrosion prognostic health monitoring for marine vessels and materials degradation for the emerging area of concentrated solar thermal power plants. Prognostic health monitoring of marine vessels is utilising commercially available sensor data and maintenance records to develop decision making tools based on the financial and failure drivers of asset owners. This project is in collaboration with Swinburne University, Australian government and a large multinational company.

The Australian Solar Thermal Research Initiative (ASTRI) is an ARENA funded project involving a number of Australian industries, universities and research organisations collaborating closely with European and US colleagues. Globally concentrated solar thermal power plants are an emerging solution to base load power and offer many challenging environments for materials to survive and thus opportunities for the material scientist. With temperatures of up to 800 ˚C in places and exposure to supercritical $CO_2$, molten salts and liquid metals a wide variety of expertise is required along with a variety of cost effective solutions. Australia has been over the last 4 years positioning itself to offer the next generation plant with higher operating temperatures, simpler deploy ability and better efficiency and looking to provide demonstration plants in the next 4 years. QUT is a key group in the selection of materials for these very challenging conditions such that a successful and reliable energy source can be realised.

QUT also works closely with our local community through secondary school engagement and final year project supervision as well as secondary school teacher mentoring and visits focusing on corrosion. We work closely with the ACA and the Queensland Maritime Museum to promote corrosion awareness and disseminate knowledge through seminars and information evenings hosted at the university. QUT offer a number of undergraduate and postgraduate courses in materials and materials degradation and look forward to promoting corrosion management through education.

**Contact:**
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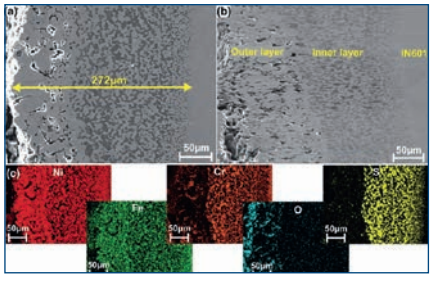
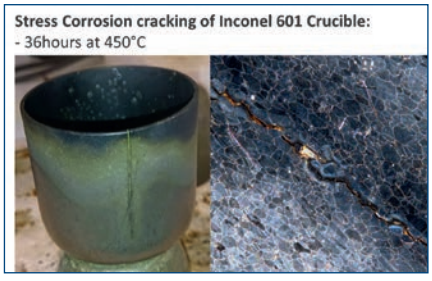
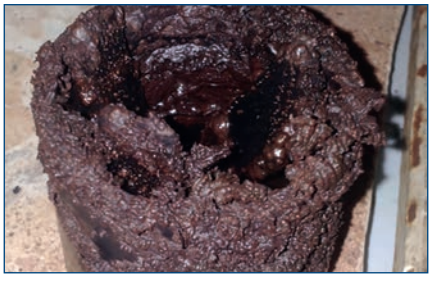
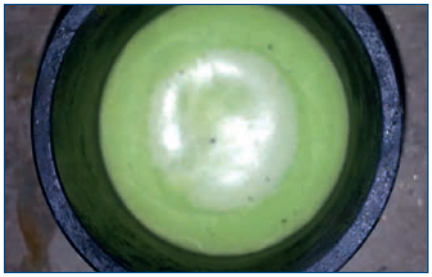



*Selective leaching in high temperature service of nickel alloy.*



*Corrosion of 316SS in molten salt.*



# NEW PRODUCT SHOWCASE

The ACA does not officially endorse any of the products advertised in *Corrosion & Materials*.



## New Olympus portable flaw detector


Olympus is pleased to announce the launch of the EPOCH 6LT Flaw Detector, designed for the unique requirements of even the most challenging conventional ultrasonic inspection applications.

Optimised for single-handed operation, the EPOCH 6LT flaw detector combines a leading-edge ergonomic design with powerful ultrasonic functionality in an instrument built specifically for rope access and high portability applications, such as inspections of offshore oil platforms, in-service wind turbines, aviation, bridges and structural steel.

"The design of the light weight, EPOCH 6LT flaw detector is optimised for user comfort, making it easy to use with one hand," explained Graham Maxwell, Business Development Manager, Olympus.

"For rope access and other high portability inspections, technicians can either use just one hand or attach it to their legs for hands-free functionality, allowing them to do inspections safely, comfortably and efficiently," he explained.

The EPOCH 6LT delivers lightweight, reliable flaw detection in the palm of your hand, weighing just 890g with a grip-orientated weight distribution.

Additional key features include:

- Hands-free operation: the device can securely be attached to a user's leg or harness with the display rotating so users can properly view the A-scan and readings
- Easy navigation: the rotary knob and simple button design make it easy to navigate through the user interface, even while wearing gloves. The device also has intuitive software featuring a two-screen, icon based interface to make navigation even quicker and easier
- Durable and reliable: engineered to IP65/67 for dust and water resistance and drop tested to protect against the hazards found in challenging inspection environments
- Compliant to EN12668-1:2010

The EPOCH 6LT features optional Wi-Fi connectivity for 'on the go' backups, set up downloads, and powerful cloud applications on the Olympus Scientific Cloud. It also has optional corrosion software, combining the ease of use of a thickness gage with the flexibility of a flaw detector.

With a simple and straightforward workflow, technicians can spend more time on their inspection and less time adjusting the instrument. For added efficiency, users can control the inspection parameters without interrupting flaw scanning.

The EPOCH 6LT has a small footprint, packed with advanced features, functions and connectivity for inspections without compromise.

**For further information:**
www.olympus-ims.com/en/epoch-6lt

## TSC develops portable acfm that lets you go at your own 'PACE'

TSC Inspection Systems, UK are widely regarded as the pioneers of alternating current field measurement (ACFM). The AMIGO ACFM system has gained considerable momentum in Australia and Russell Fraser Sales is thrilled to announce TSC's newest innovation; an entirely portable ACFM system that allows the NDT technician to go at their own "PACE™". No longer will some jobs be off limits; take PACE with you to the inspection site and discover the time and cost saving benefits of using ACFM for highly accurate surface crack detection. PACE offers reliable, repeatable ACFM crack detection with defect sizing, length and depth.

PACE is a robust, single user ACFM instrument with a daylight readable, strengthened LCD screen and IP65 rating. PACE has a long battery life of 8+hours and enhanced software inspection reports detailing defect sizes, locations and scans, plus an on-board camera to enrich reports, with the option to include detailed imagery from the inspection site.

TSC's new pencil style probe range SENSU™ partners PACE and features straight nose and right angle nose probes which can perform continuous scanning whilst being able to gain access to challenging tight angle inspection areas.

**For more information contact Russell Fraser Sales today:**

T: +61 2 9545 4433
E: rfs@rfsales.com.au
Web: www.rfsales.com.au

## FLIR EXX-Series E75, E85, E95

FLIR has released three brand new thermal imaging cameras as part of their updated Exx-Series range with increased resolution, better thermal sensitivity, and a host of excellent hardware and software developments. The FLIR E75, E85 and E95 offer enhanced resolution, temperature ranges, and measurement capabilities. The lenses are interchangeable, the focus has been upgraded to laser guided and Wi-Fi has been enabled.

The FLIR Exx-Series cameras have received an increase in resolution, with the lowest resolution being 320 x 240 for the E75 (76,800 pixels). The FLIR E85 is 384 x 288 (110,592 pixels), and the FLIR E95 offers a beautiful 464 x 348 (161,472 pixels) image. Sensitivity (NETD) is the same on all three imagers, rated at 0.04 °C for the standard 24 degree lens.

Sensitivity gets even better for the 42 degree wide angle lens (0.03°C). The FLIR E95 will measure temperatures up to 1500C° - unheard of in this price range!

One of the best additions to the FLIR Exx-Series is the laser guided auto-focus. The cameras have a built-in laser distance meter that can precisely measure to 30m. The camera then uses this data to focus the lens for the target distance. This amounts to a very accurate and quick focus at the push of a button. The E85 and E95 also use the laser distance meter for another feature: calculating area. Because the distance and lens qualities are known to the camera, you can draw a box on the touchscreen and the E85 and E95 can tell you the area contained by that box (square feet or square metres).

Normally getting an accessory lens for your thermal camera meant you needed to return it the manufacturer for calibration. FLIR now includes a chip on the lens that carries calibration data from the factory. So you can get an additional lens, attach it to your camera, and run the built-in calibration program. One lens can be shared between multiple cameras and lenses are no longer tied to a single camera.

FLIR has also created a fabulous new touchscreen which is 30% larger, 33% brighter, and has a wide 160° viewing angle. If you need to share the camera, you can use the built in Wi-Fi to relay the live screen to your phone or tablet. The touchscreen is made of tough Dragontrail glass and makes use of multi touch gestures for a greatly improved interaction. You can use two fingers for pinch zoom, or swipe down from the top to access frequently used shortcuts.

The new E75/E85/E95 imagers also boast UltraMax super-resolution imaging, to combine multiple images into a single image of double the original resolution. Communications include Wi-Fi to a phone or tablet, Bluetooth to FLIR electrical and moisture instruments, and even GPS to record where each image was taken. You can capture still images or thermal video (and even time lapse on the E95).

For more information or to request a demonstration contact Russell Fraser Sales today:

T: +61 2 9545 4433
E: rfs@rfsales.com.au
Web: www.rfsales.com.au

# Moisture as a cause of CUI

By Andy Hoffman

*Aerogel in its unhydrated state.*

Moisture is one of the major factors to consider when investigating corrosion under insulation (CUI). Accumulating water within an insulation system can wreak havoc on metal piping, ventilation and other insulated surfaces, originating from a variety of sources, including condensation within the systems, water spray from deluge systems, drift from cooling towers, process leakage or rainfall. But moisture can cause another problem while it goes untreated: a reduction in efficiency.

The industry consensus is that most insulation systems, in certain temperature ranges, will get wet. Corrosion rates are reduced below freezing temperatures, and at elevated temperatures above 149°C most moisture evaporates before reaching the surface. Therefore, the target temperature range for CUI is 0°C – 149°C. This is where owners should assume that these systems would become saturated. Whether the"cladding"was installed improperly or was damaged from a number of possible causes, the general thought remains that moisture will eventually enter the insulation system.

Regardless of the cause, once the insulation gets wet there is a significant impact on efficiency. In heated systems, moisture ingress causes convection cells to form within the insulation where water vapor is generated on the steel surface and driven outward. It condenses on the inside of the cooler jacket wall and then is reabsorbed by the insulation in a process known as refluxing. Refluxing leads to concentrations of corrosive species in the insulation.

In cooled systems, ingress of water vapor from the surrounding air condenses onto the colder pipe surface and is then absorbed by the insulation closest to the pipe. Since water has approximately 15 times the thermal conductivity of most dry thermal insulation materials, this absorption affects the insulation's efficiency. Water in the insulating fibers also causes a matting effect where the fibers compress onto one another, negating the insulation benefits associated with the still air pockets within the insulation material. As little as 4% water absorption into dry insulation can increase its thermal conductivity by 70%. This loss in efficiency increases energy consumption where operational temperature variation cannot be managed and so avoid the issues owing to plant design and capacity.

## The Promise of Aerogel Insulating Coatings

The financial drain caused by moisture intrusion has left facility owners looking for other insulation options. An alternative to traditional insulation is using an insulating coating. Insulation coatings are not a new technology, but within the last five years insulation coatings containing aerogel have become available. On paper, aerogel-infused coatings can achieve a thermal conductivity on par with most traditional insulation materials, while also resisting the infiltration of moisture. These insulation coatings containing aerogel also have been used in other applications: to control condensation and provide a 'safe-touch' barrier to protect personnel from hot equipment.

Researchers developed a test that evaluates the thermal performance of various insulation materials before, during, and, most importantly, after being submerged in water.

The test consisted of a 1.5 m trough that could be filled with water and drained. Copper pipes, 50 mm diameter with a total bent length of 1.8m, were insulated with the appropriate materials. Thermocouples were installed on the inlet and outlet of these pipes in order to monitor the individual efficiency of each pipe. The thermocouples recorded the water temperature as it came into the pipe and also as it left the pipe. A water heater pumped 60°C water through the copper pipes, and a water chiller was used to maintain the water in the trough at 10°C when flooded. This ensured consistency in the water temperatures being circulated through each pipe. Figure 1 is a diagram of the test set up and Figure 2 shows the test trough with bare copper pipes.

Before installing any of the insulation materials, the bare pipes were run dry for several days to establish a baseline and to demonstrate consistency across the various positions in the trough. As expected, heat loss from the pipes increased dramatically when the trough was filled with water. Once the water was drained from the trough, the bare pipes returned to their initial dry performance within a few hours.

Once a baseline was established on the bare pipes, they were then insulated with the appropriate test materials for longer-term evaluation. Four different pipes were tested, including:

- One bare pipe
- One pipe coated with an aerogel coating system
- One pipe wrapped with mineral wool and cladding
- One "duplex" pipe: aerogel coating underneath mineral wool and cladding

In the case of the pipes coated with an aerogel coating system, the copper pipes were prepared according to SSPC-SP2 Hand Tool Cleaning. The pipes then were coated with an epoxy primer after they were first lightly sanded by hand. Since there was not extensive thermal cycling in this test, extensive surface preparation was not required.

Two coats of the aerogel coating were applied for a total of 2.5 mm dry film thickness (DFT). The pipe was topcoated with a water-based epoxy.

An insulation contractor completed the installation of the mineral wool and cladding after the two pipes were coated with the same epoxy primer. The duplex pipe then had two coats of the aerogel coating applied and both pipes were wrapped with 50 mm of mineral wool. The aluminum cladding was installed over the mineral wool. In all cases, the pipes were weighed before being placed back into the trough to note a baseline weight of the original insulation.

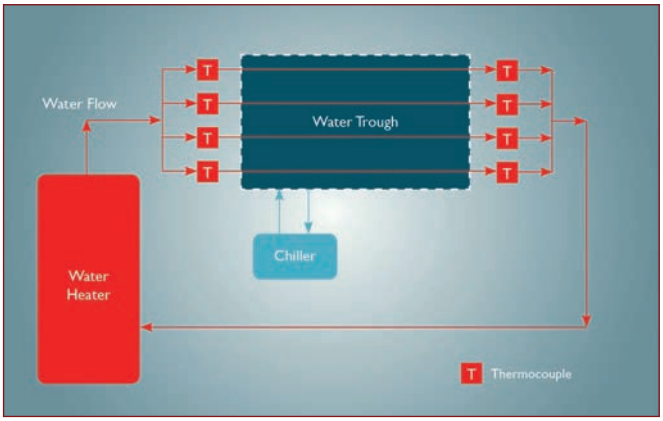



Figure 1: Thermal performance test set up.

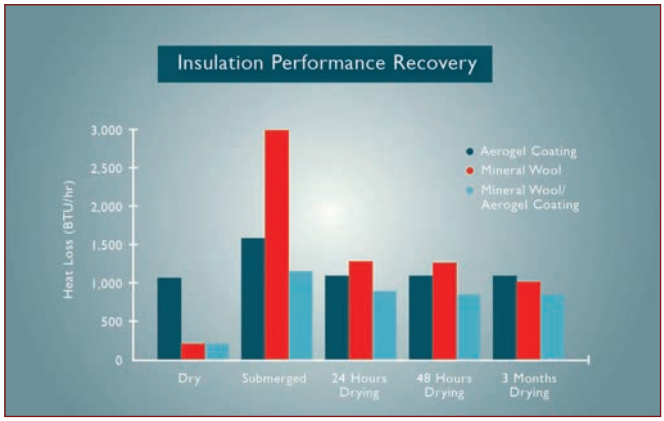



Figure 3: Insulation Performace Recovery.

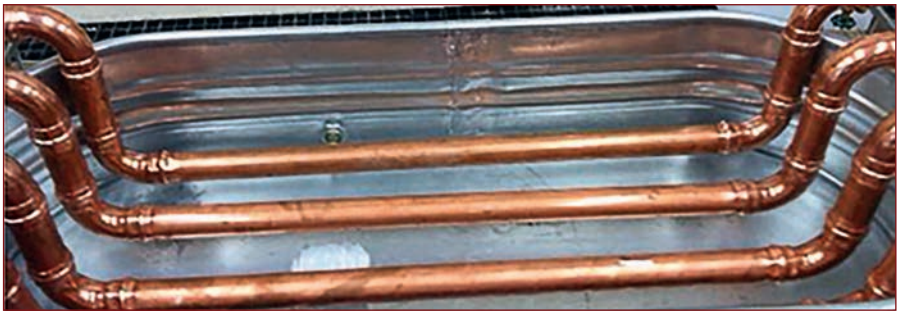


Figure 2: Test trough with bare copper pipes.

All four of the pipes were run side-by-side for two weeks in an empty trough to establish their dry performance. The trough was then filled with water for 24 hours. The performance was again monitored through the thermocouples on both ends. Finally, the trough was drained and the performance was monitored over the next few months while the pipes dried out. Table 1 details the results.

## Insulation in Recovery

As expected, the initial dry performance of the mineral wool was significantly better than the aerogel coating. Even though the performance rating of the aerogel coating is slightly better, the mineral wool was installed 20 times thicker than the coating (Figure 3).

The test data became interesting once water was introduced into the trough. The heat loss performance was first measured while submerged in water, showing a drastic spike in heat loss on the mineral wool pipe. The submerged data was telling, but the main purpose of the testing was to see how these materials reacted to getting wet and the impact on their long-term performance.

Twenty-four hours after draining the water from the trough, the aerogel-coated pipe had returned to its original heat loss performance while the mineral wool struggled to dry out and regain some of its original dry performance. Ultimately, after having a full three months to dry, the mineral wool still was losing five times more heat than its original performance.

The drop in performance of the mineral wool is driven by a couple of factors. First, during submersion there was water ingress into the insulation through small leaks in the cladding. The water was absorbed by the fibers and it filled the air pores between the fibers. This effect was evidenced by the weight gain of the systems. The original weight of the mineral wool was 0.64 kg.; the weight after being submerged was 4.54 kg. During the 3-month check, the mineral wool still was 1.50 kg., which is over twice its original weight. In higher temperature applications, more of this water will likely evaporate, but while wet, the insulating air inside the mineral wool is displaced by moisture.

## When Forces Combine

The last pipe involved in the testing was a duplex system of both materials. This consisted of the same epoxy primer and 2.5 mm of the aerogel coating followed by 50 mm of mineral wool and cladding. The dry performance was very similar to the dry performance of the mineral wool, but the performance after being submerged was better. After just 24 hours of drying, this duplex system was more efficient than the aerogel coating by itself, with half the heat loss of the mineral wool pipe. This is due to the fact that the aerogel coating itself is delivering additional performance to the system and helping to overcome the deficiencies of the drying mineral wool. The duplex system that combines the aerogel coating and mineral wool brings superior performance before, during and after exposure to water. The downside of the duplex system in a real-world scenario is the cost and installation of both materials, so a cost-benefit analysis would need to be done to warrant this option.

Facilities are doing more every day to minimize potential issues related to CUI. However, the economic impact of energy loss due to wet insulation is often overlooked. It can take several years to detect CUI, during which time the insulation is underperforming and costing the facility owner. An understanding of the financial ramifications of wet and underperforming insulation is a necessary step in not only developing a CUI strategy, but also selecting the proper insulating materials for any given environment.

*Courtesy of Corrosionpedia.com and Tnemec Company*

| Insulation Material | Thickness | Thermal Conductivity @ 21°C (mW/mK) | R-value (initial dry pipes) | R-value (pipes 3 months dry) |
|---|---|---|---|---|
| Aerogel Coating | 2.5 mm | 35 | 0.41 | 0.43 |
| Mineral Wool | 50 mm | 40 | 7.2 | 0.48 |

Table 1: Test results comparing pipes insulated with aerogel and mineral wool.

# Pure Polyurea, Corrosion Protection & Offshore Oil Rigs

Both abrasive and corrosive, the marine environment is unforgiving of maritime structures such as offshore platforms, rigs, and ocean-going vessels—all of which are major investments for the companies operating them. All activities in a marine environment are impacted by corrosion; the prevention, control and remediation of which costs industry billions of dollars each year. One way to minimise and mitigate the effect of some types of corrosion is through the use of surface coatings that are flexible and resistant to chemical attack from salts and petroleum products . Polyurea based coatings have the necessary durability and flexibility to operate in this hostile environment.

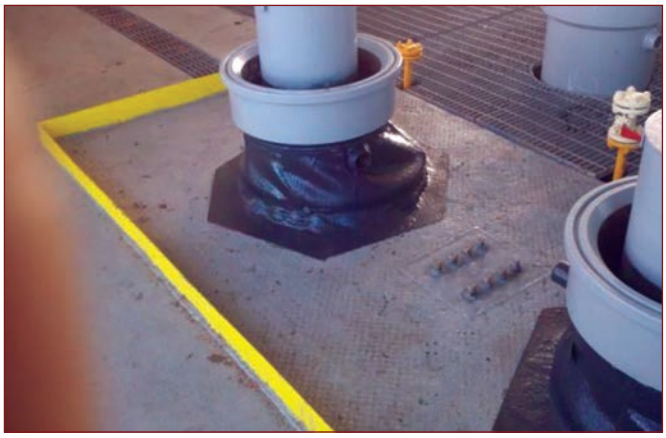
The operating conditions experienced on an offshore structure are also harsh on surface coatings, both in terms of how they wear and also how they are applied. The areas most affected are the decks, superstructure, ballast tanks and anchor or chain wells. These are exposed to salt and other chemical agents as well as to abrasion and impact. To enhance safety for personnel moving around an offshore structure or vessel, spray-applied surface coatings with anti-slip properties can easily be applied to decks to provide safe walkways.

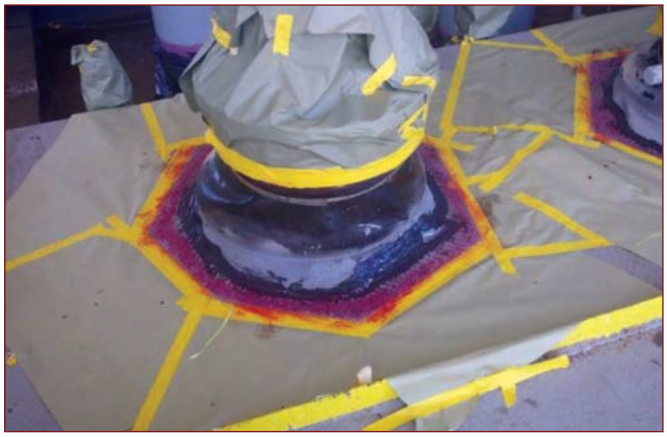
## Corrosion Protection for Off-Shore Oil Rig Skid Deck

**Applicator PickWest Enterprises, Inc., California created a non-slip, weather resistant and high impact surface with long term durability demanded by this industry**

On an offshore oil production rig, the top deck (rig skid) of the oil platform is the main area where 14-metre lengths of drill pipe are laid out. The drill pipe is dragged across the deck as they are pulled up for drilling operations. The pipes damage any coating put on the steel deck and then the abraded steel is exposed to corrosion.

To prepare these working areas for treatment the platform deck was abrasive blasted to a Sa 2 ½, 50 to 70 micron profile to clean off any existing coatings and also profile the surface for optimal adhesion of a primer and the Rhino Linings protective coating. A zinc-rich primer was applied to the prepared metal surface @ 20-25 micron, over which a Rhino Pure Polyurea was applied to a nominal thickness of 3000 microns on the deck surface. Rhino Linings Pure Polyurea was chosen for its resistance to weather extremes, excellent flexibility and high impact strength. Masking of fittings before application of the coating system is shown in the four figures below. Further, the ability to walk on the spray applied, fast cure surface in a matter of minutes






after application meant that the facility was back on line sooner. A major consideration in applying any surface treatment to a structure is the requirement to minimise downtime. Spray coating enables quicker application and less disruption to a client's operations.

## Off-Shore Oil Platform Deck Penetration Boots

**PickWest Enterprises, Inc., California created a watertight, weather-resistant, flexible interface for long term durability on all deck penetrations 6" in diameter and greater.**

Where pipes and other equipment penetrate the deck areas of offshore structures, it is important that operational liquids do not run down the pipes to the ocean below. Most offshore rigs cover these penetrations with a butyl rubber 'boot' that is taped to the pipe and deck. However, the rubber of the boot and the adhesive can be degraded by UV and salt exposure in a matter of months. To extend the operational life of the deck penetration boots, the butyl rubber and the adjacent steel surfaces were scuffed (rotary plastic cup brush for rubber and bristle brush for steel, followed by solvent cleaning) before the appropriate primers (Rubber 15-20 microns, Steel 20-50 microns) was applied. It is important to note that all loose coatings, oils and dirt are thoroughly removed before applying any new flexible membrane. Similarly, the surrounding equipment, piping and deck surfaces must be masked off to protect against overspray. The coatings applicators recommended Rhino Linings Pure Polyurea to use with the boots. The product, was applied at a thickness of 2000 microns or greater, and extended 50 mm up the pipe and 100 mm onto the deck, creating a liquid tight, weather resistant, flexible interface on all deck penetrations.

## About Pure Polyurea

Pure polyureas are formed when a liquid isocyanate is mixed under high pressure and high temperatures with an amine-based resin solution. Isocyanates are reactive because the double covalent bond attaching the carbon atom to nitrogen and oxygen atoms which are easily broken to form single bonds in the more stable tetrahedral configuration around the carbon atom.

When applied to the substrate, the excellent chemical cross-linking produces a dense but flexible surface. The high density makes the coating almost impervious to abrasion, water and chemicals.

Pure Polyurea coatings 'snap cure' to form a solid surface in a few seconds and can be walked on without damage in less than a minute. Another advantage is the ability for it to be sprayed up to 6000 microns thick (and greater) on a sloping or vertical surface without sagging or running. The resulting surface is easy to maintain, clean and recoat if necessary. The ease of touch-up contrasts markedly with epoxies and most other paints which form a solid, rigid shell. The flexibility of pure polyurea coatings allows them to move with the expansion and contraction of the underlying structure as temperatures change.

**About Rhino Linings Australasia Pty Ltd (RLA).**

RLA was formed in 2001 and established manufacturing and distribution capabilities for the Australasian region. RLA manufactures its spray applied coatings at a facility on Australia's Gold Coast and can draw on the more than 30 years' experience of its American parent. The company sources all its materials from local suppliers except for some very specialised chemicals which are imported from the United States of America.

Rhino Linings®

# Coating Refurbishment of Domain Tunnel Ventilation Stack, Melbourne

Transurban's Grant Street Ventilation Stack for the Domain Tunnel has recently been refurbished by Mattioli's industrial coating team. The Stack is close to 50 metres high and nearly 8 metres in diameter.

The Domain Tunnel is a road tunnel located in the centre of Melbourne which carries traffic westbound from the Monash Freeway to the West Gate Freeway. This and the eastbound Burnley tunnel are part of the CityLink Tollway network operated by Transurban and provides a bypass of the central business district. Emissions from these tunnels are discharged via two ventilation stacks, one being the Grant Street Ventilation Stack.

The primary objectives of the works were to repair corrosion to the red steel elements of the structure and to repaint the red steel elements and the black tubular column in accordance with the drawings and specifications outlined by Transurban.

Consultancy KTA-Tator Australia Pty Ltd carried out an initial inspection report of the coatings and corrosion condition of the Grant Street Vent Stack. "The structural steelwork and metalwork of the vent stack was shop-coated before erection with a zinc primer, epoxy intermediate and polyurethane topcoat system, with most structural members coated with a bright red (believed to be Cherry Red) colour."

Mark B. Dromgool, Managing Director of KTA-Tator highlighted "Tension rods and their clevis plates are typically coloured aluminium. Records indicate that the protective system was applied around 2000, meaning it is now between 15 and 17 years old. The coating system is still quite sound for

its age, suggesting it was generally quite well applied. The gloss level of the red topcoat has dropped to quite an extensive degree, especially on the western and northern sides of the structure and of individual members. Some quite noticeable chalking of the topcoat has also occurred on the same orientations." The localised degradation is consistent with wind borne sea salt from Port Phillip Bay and solar irradiation on the northerly aspects. Chalking damage on the surface was due to weathering and the paint binder slowly being degraded by sun and moisture. When it came to a coating renewal, it was essential a new system had a UV stable top coat for long term durability and colour retention.

Mattioli's initial start to the project was to water jet clean all surfaces (including the concrete core) using high pressure potable water at 4,000 psi (27.6 Mpa). The next crucial task involved spot power tool cleaning of all areas that showed signs of rusting, under film corrosion, poor adhesion which were cleaned in accordance with SSPC-SP 11.

A key area of the works was to repair corrosion to the red steel sections, starting with 75 microns of an epoxy zinc rich spot primer (*Zincanode 402*) to prime the most affected areas followed by a spot intermediate coat of epoxy mastic (*Durebild STE*). The prepared steel then received a full 80 micron intermediate coat of the epoxy mastic and a 75 micron top coat of high build recoatable polyurethane (*Weathermax HBR*).

The client praised Mattioli at the end of the project on another successful and professional outcome. This was due to an ahead of schedule date of completion and no complaints from the public residing next to the ventilation stack.

*Case study submitted by Mattioli – Innovators in Protective Coatings, who are a leading protective coating applicator in Australia, based in Victoria.*

MATTIOLI
INNOVATORS IN PROTECTIVE COATINGS

# When is a Paint Dry?

**Rob Francis**, R A Francis Consulting Services, Ashburton, Victoria, Australia

## Introduction

This seemingly simple question of *When is a paint dry* may appear as exciting as watching paint dry, but in fact shows some complications that can arise with definitions in the coatings industry. These can be introduced with a simple example. The term "high build" as it applies to paint coatings is widely used, but when exactly does a paint become "high build"? Looking at three different sources, we obtain the following definitions for "high build":

- ISO 12944-5: "Property of a coating material which permits the application of a coat of greater thickness than usually considered as normal for that type of coating. NOTE For the purposes of this part of ISO 12944, this means ≥ 80 µm dry film thickness per coat" (1).
- SSPC Protective Coatings Glossary: "Coatings that are applied in thicknesses (minimum 125 micrometres) greater than those normally associated with paint films and less than those normally applied with a trowel." (2)
- AS 2310: "A paint that enables the application in one coat of a thick film of paint greater than 100 µm." (3)

Having three quite different values (ie greater than 80, 125 or 100 microns) is a good illustration of the inherent confusion.

There is no definite thickness when a coating becomes "high build". As indicated by the ISO and SSPC definitions, it means a paint that can be applied in a greater thickness than normal for that type of coating, but this varies depending on generic type becomes a "high build". For alkyds, chlorinated rubbers or polyurethanes which are normally applied at around 50 microns per coat, a high-build is one which can be applied at around 75 microns. For an epoxy primer normally applied at 75 microns, a high build can be applied at around 125 microns or greater.

While these differences are unlikely to cause any problems with a coating job, this example shows how terminology can have different meanings in different parts of the world, indeed within standards which should have undergone thorough peer review. In addition there can also be variations in meaning of terms between different paint companies, further confusing the user. This article looks at drying and curing times of coatings and differences in definitions and use between various standards and manufacturer's product data sheets (PDS).

Coating users should be aware that drying and curing are not the same when it comes to paint coatings, and that there are a number of stages involved in drying and curing from initial application to complete cure. It is imperative that the differences between surface drying and complete curing are clear, otherwise a coating will certainly fail if exposed to its design environment too early. Similarly, a painted item that is transported too early will be subject to damage and require repair if not complete recoating. Overcoating too soon or too late will almost always result in coating failure. The drying and curing stages for a coating system must be clearly defined and understood by applicators, inspectors and specifiers and there must be no ambiguity regarding their meaning. The difficultly arises when trying to define these stages.

Drying and curing of heavy duty coatings will usually involve several physical and chemical changes, such as solvent evaporation, reaction with oxygen or moisture, polymerization or some combination of these. The time to reach a given stage is difficult to measure and considerably influenced by environmental factors such as temperature and humidity as well as film thickness. The stages are often not defined according to the physical or chemical changes, but whether they meet some standard test.

## Early Stages

The early stages of drying are important in laboratory testing, but less important for protective coatings in a paint shop or the field. However, the earliest stages of drying are of interest in that they indicate that the curing process is under way. The most common term for initial drying is touch dry which, according to AS 2310 (3), is defined as "The stage during the drying or curing process when the paint film no longer feels sticky when lightly touched". This stage may also be termed tack-free or surface dry, although some standards will have slightly differing definitions or tests or both for these terms. International Standard ISO 9117-3 (4) is a test for surface drying where it is defined as the point where small glass spheres (ballotini) can be lightly brushed from the surface of the coating without damaging it. The term "dust-free" is used in the USA (2) to designate the point in time when dust will no longer adhere to drying paint, which would appear to be a similar stage in the drying process. "Print free" may be used for air drying paints to designate either the time after which a piece of cloth with a weight on it leaves no marks, or the time when the coating can be pressed with a thumb and leaves no mark. The subtle differences between the terms and degree of drying are of little consequence in the heavy-duty coatings industry. At this stage, the coating is still soft and mobile and cannot be handled without damage.

## Drying and Curing

The first stage of real practical importance is commonly referred to a 'dry-to-handle' which means the item can be moved to complete coating application and the film thickness can be measured. According to AS/NZS 2310 (3), this is defined as "A state during the drying or curing process when the paint film has hardened sufficiently for the object to be moved carefully without marring the film." SSPC (2) has a similar definition but crucially avoids the use of the word "carefully". The implication of this is that, without requiring care during handling, the coating will have reached a slightly greater degree of cure and hardness at the dry-to-handle stage according to the SSPC definition compared to the AS/NZS 2310 definition. These apparently subtle differences can become critical factors in any litigation.

Not all paint companies give a 'dry-to-handle' time on their Product Data Sheet. One company uses the term 'dry-to-walk-on' which again would appear to require a greater degree of cure than the AS/NZS 2310 definition, but could be considered much the same for practical purposes. However,

another company uses the term 'hard dry' for what appears to be this stage in the drying process. This company defines 'hard dry' as "The condition of the film in which it is dry throughout its thickness. This through drying state is determined by the use of a "mechanical thumb" device which, when applied using a specified gauge, under specified pressure, torsion and time, does not mark or damage the film." This definition is from ISO 9117-1 (5), and SSPC and ASTM have similar definitions for 'hard dry'. Traditionally, painters have tested for 'hard dry' by twisting their impressed thumb on the painted surface and noting any damage. The laboratory test apparatus mentioned reproduces this action. The thumb test, however, is still a useful guide and used in the workshop and field. 'Hard dry' is usually taken to mean the item can be moved or turned, although this is not stated in the definition and it may not be clear to an applicator. AS/NZS 2310 defines "hard dry" as "The stage reached during a drying or curing process when a paint film has sufficient strength to withstand mechanical damage" and notes that 'through dry' has the same definition. So, although different terms are used, the times given for dry-to-handle, hard dry, dry-to-walk-on and through dry in the various companies data sheets can be considered as a roughly equivalent point in the curing cycle. However, using different terms for the same stage could be confusing to the applicator.

## Dry to recoat

The next stage is the 'overcoating interval' or minimum and maximum 'time-to-recoat' and most companies use one of these terms. The AS/NZS 2310 definition is "The stage during the drying or curing process when the next coat can be applied without deleterious effects". Other standards and glossaries will give similar definitions and there is unlikely to be any argument as to its meaning. However, a problem does arise when recoating with the same product. Building up thickness of a coating that is under thickness can usually be carried out earlier than overcoating with a different generic type. Most data sheets do not acknowledge this, unless the coating is designed as a single coat system. Use of the term "recoating interval" for applying the same coating, and "topcoating interval" for a different coating would avoid this, but these distinctions have not been adopted. This situation indicates that more work is needed on tightening up definitions in the relevant standards.

## Full cure

A coated item should not be subject to its environment until the coating is completely cured, often referred to as "full cure" although interestingly, standards such as AS/NZS 2310 do not define this time interval. Strictly speaking, this term is incorrect because some coatings will continue to polymerise for days, weeks or even longer after application, even though they will not be damaged by the environment. What the term represents is the point at which the coating is fully hardened, cohesive and can be subjected to its design environment. It can also be subject to holiday testing, if required, although practically this is usually carried out before the maximum time-to-recoat to ensure repairs adhere. Full cure can be more correctly referred to as "cured for service" or "return to service"; terms used by some paint companies. Not all companies give such a figure, perhaps because this time is almost impossible to determine using any general field test. Ideally, a cure/ hardness test, such as MEK rub or Barcol hardness and an acceptable pass level should be provided as an indicator of acceptable level of cure where this is critical.

Other special curing requirements can be valuable but rarely provided. For example, inorganic zinc silicates (IZS) can resist a shower of rain well before they are dried to recoat or even handle. For example, AS 3750.15 requires solvent-borne IZS and high ratio water-borne IZS to reach water insolubility within 1 hour, and ordinary water-borne within 3 hours. However, no products available in Australia or NZ provide such information on their data sheet.

Table 1 provides a summary of the terms used in paint drying and curing, and the importance of the term. Users of protective coatings not only need to be aware of the meanings of the common terms, but the alternate terms used within the industry.

*[This article is extracted from a paper presented at the ACA Conference in November 2016 in Auckland, New Zealand]*

## References

[1.] ISO 12944-5, "Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems", 2007.

[2.] SSPC Protective Coatings Glossary, SSPC, Pittsburgh, PA, 2011.

[3.] AS/NZS 2310, "Glossary of paint and painting terms", Standards Australia, Sydney, 2002.

[4.] ISO 9117-3, "Paints and varnishes -- Drying tests -- Part 3: Surface-drying test using ballotini", 2010.

[5.] ISO 9117-1, "Paints and varnishes -- Drying tests -- Part 1: Determination of through-dry state and through-dry time", 2009.

*Even after curing, paint coatings must be handled and transported carefully.*

| Common Term | AS/NZS 2310 Definition | Alternate terms | Importance |
|---|---|---|---|
| Touch dry | The paint film no longer feels sticky when lightly touched | Tack-free, surface dry | Drying/ curing is under way |
| Dry to handle | The paint film has hardened sufficiently for the object to be moved carefully without marring the film | Dry-to-walk-on, hard dry, through dry | Items can be turned or moved, DFT measured |
| Overcoating interval | The next coat can be applied without deleterious effects | Time-to-recoat | Next coat can be safely applied |
| Full cure | (Coating can be put in service) [Definition not in AS/NZS 2310] | Cured for service, return to service | Item can be put in service, holiday testing carried out |

*Table 1: Summary of Major Coating Drying and Curing Intervals.*

This Paper was originally presented at Corrosion & Prevention 2016

# Refurbishment of Makatote Viaduct, New Zealand

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## 1. Introduction

The Makatote Viaduct is on the North Island Main Trunk (NIMT) Railway line, which is a 680km long railway that connects Auckland and Wellington, the two major cities in New Zealand (NZ). Due to both natural and man-made difficulties it took nearly 40 years to finally complete the whole route[1]. The railway passed through some of the most challenging terrain in the North Island and required engineering ingenuity to complete. Additionally, there was resistance from the local Iwis, who were against the settlement made between the tribal leaders and the Government.

The viaduct was one of the last pieces to be completed on the route, which was opened in 1908. At 78m above the stream it was the highest structure on NIMT until 1981. Its elegant tall and slender steel trestle piers with light-weight trusses rising through the gorge with the backdrop of National Park have made it an iconic structure (Figure 1). It has been one of the most photographed steel rail viaducts in New Zealand[2]. The Viaduct has been assessed for and found to possess aesthetic, historical, social and technologically significant values[3].

When the viaduct celebrated its centenary in 2008, it became apparent that the structure required refurbishment to extend its life and improve the resilience of the NIMT. To this end KiwiRail commissioned contractor TBS Farnsworth and design engineers Opus International Consultants (Opus) to undertake a detailed load assessment, strengthening and repairs to improve the load capacity and repainting of the entire viaduct. The physical works commenced in September 2014 and was completed in October 2016.

This paper presents the details of this work together with some critical challenges overcome on site.

*Figure 1: Makatote Viaduct in a Pristine Environment.*

## 2. Viaduct Description

The viaduct bridges the Makatote Gorge 12km south of National Park in Central North Island, NZ (Figure 1).

It is 262m long and 78m high. It comprises 5 No. 30m (100') deck Pratt trusses and 10 No. 11m (36') plate girder spans, five of which act as pier heads for the five cross braced steel towers (Figure 2).

The viaduct is a riveted structure with the girders on the piers and components of the trusses being built up using a large amount of small section lacing. The total area of coated steel is 15,400m².

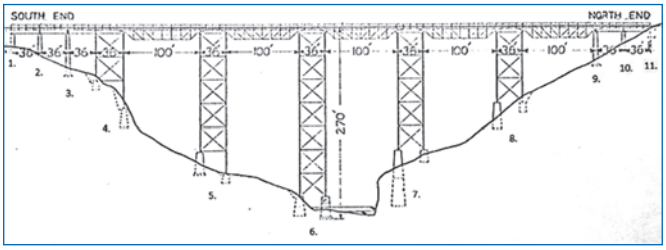


*Figure 2: Schematic diagram of bridge structure underneath the cross-section of the bridge.*

## 3. Previous Work On Viaduct

1925 - Along with other bridges and viaducts on the NIMT, the Makatote had its truss spans strengthened to ensure it could bear the heavier class of locomotive that was being introduced[1].

1950(s) - Full abrasive blast and prime with lead based primer and two coats of a MIO alkyd build and finish coat.

1982 - Underpinning occurred on Pier 6 due to concern about scour risk of footing.

1982 - Reinforced caps and stressing cables were installed on Piers 3 & 9 for seismic resilience.

1986 - Strengthening and modifications for electrification.

1997 - Partial paint touch up of Piers 4 and 5 using a spot abrasive blast and full overcoat with moisture cured urethane.

2007 - The last significant addition to the Makatote Viaduct was the underpinning of Pier 7 due to concerns over scour.

## 4. Refurbishment Issues

### 4.1 Corrosion

One of the major concerns was the deteriorating paint system leading to significant corrosion and section loss of key elements on the viaduct. Although the existing coating has performed adequately since the last full blast and paint of the viaduct some 50 years ago, there was significant breakdown of the coating in many places and heavy corrosion very evident with some lacing elements having already been replaced (Figure 3). Like many in the world, the viaduct's coating system was based on red lead primer (RLP) which was used extensively until the 1990's due to its excellent performance characteristics and tolerance to poor surface preparation. It is unfortunately also harmful to the environment and humans and it is no longer in use in most parts of the world. There was an attempt to overcoat the existing lead based coatings in 1997 but poor application quality assurance and a lack of compliance to environmental based consent conditions caused the project to be cancelled when only partially complete.

*Figure 3: Heavy corrosion*

A 2010 reassessment of the coating system found the adherence of the RLP to the steel substrate was now compromised meaning it would have to be removed and a new coating system installed. Removal of RLP requires a full enclosure surrounding the subject elements so that the RLP will not be discharged to the atmosphere.

### 4.2 Strength

The current allowable axle load is 18T on a 30m truss. The future axle load requirement has been set at 20T for locomotives and 22.5T for wagons respectively.

The normal rating of the structure is shown member by member in Figure 4 with the red line representing the required future load. Fifteen members of each truss are shown to be understrength. The towers were originally designed to resist hurricane force wind and this resulted in them having sufficient capacity for the future increased loads.

The execution of the work required significant temporary works in the form of access scaffolding and containment. The dead loads of the scaffold and the live wind loads of the containment could easily overload an already weakened structure and required close engineering management.

### 4.3 Environmental

The structure is in a pristine natural alpine environment with part of the structure in the Tongariro National Park. The Makatote River is a habitat of the threatened Blue Duck (Whio) and the river is a stunning clean mountain river with outstanding water quality (Figure 5). The previous attempt to paint the structure resulted in the contractor and owner being served with cessation notices by the statutory authority (Horizons Regional Council).

*Figure 5: Whio (blue duck).*

*Figure 6: Winter Conditions.*

### 4.4 Weather

The viaduct is located on the southwestern slopes of Mount Ruapehu and is 700m above sea level. The closest weather stations have recorded an average of around 200 days of rain fall per annum. During the winter snow is not uncommon and frosts can be very severe.

## 5. Appointment of TBS Farnsworth

As a legacy of the previous painting attempt in 1997 there was reluctance from the stakeholders to give consent for the works when KiwiRail approached them again in the early 2000's. KiwiRail needed to demonstrate exactly how they would protect the environment, because the traditional approach had been to get a specification, a resource consent, then engage a contractor to deliver the project. KiwiRail chose

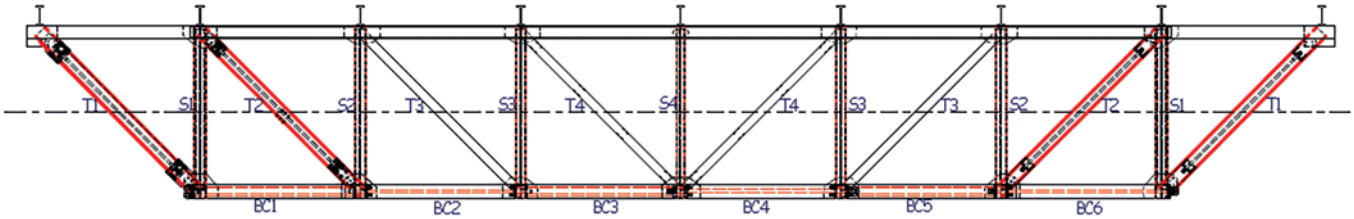


*Figure 4: Truss schematic with strengthened elements in red.*

to go to the market early to engage a contractor who would lead the system specification, the methodology and work with them to obtain the required resource consents. This resulted in three conforming bids with costs within 10% of each other. TBS Farnsworth (TBS) was selected as the preferred tenderer in February 2011.

Due to a funding shortfall the project was delayed for a year, then in early 2012 TBS was engaged in an early contractor involvement (ECI) agreement to carry out the following work.

- Select coatings system and prepare specification (Opus led by Willie Mandeno)
- Develop detailed methodologies for all works (TBS)
- Carry out detailed design of the strengthening of the trusses (method by TBS, detailed design by Opus)
- Obtain resource consent (by Opus)
- Design access and containment (TBS)
- Design a replacement inspection walkway (Opus & TBS)
- Assess loads on viaduct from access and determine sequencing of the works to manage the load. (Opus & TBS).

All of the strengthening work was valued and a lump sum contract was awarded to TBS in June 2014 for the full refurbishment, including strengthening and structural works to be completed by January 2017.

## 6. Coating System

Opus International Consultants were engaged to prepare a specification for the bridge. This involve generating a brief on the current condition of the structure, the environment and the coating design life of nominally a minimum 50 years until full replacement and then going to the market and obtaining proposals from coating manufacturers.

As a result of poor structural detailing of certain elements on a viaduct located in a harsh environment, there were many areas in which water pooled. Combined with a lack of maintenance, this resulted in significant corrosion damage. A coating system using an epoxy primer was selected to be compatible with this, and a urethane top coat was selected to provide the best weathering properties.

A supplier short list of International and Carboline was agreed upon. As the brush coating was such a large component of the work the final decision was made after reviewing cold weather curing performance and brushing trials. Altex Coatings Ltd was chosen as the preferred supplier to provide the Carboline coatings.

The initial specification called for a low pressure wash to remove vegetable matter and salts. The capture and disposal of the lead contaminated water was a major environmental obstacle so trials were carried out which demonstrated the wash was not required and all cleanliness standards were readily achieved by abrasive blasting with garnet. The heavy rainfall at this location proved to be an asset in this regard.

The initial coatings specification was:

- Dry abrasive blast to Sa2½ with a profile 40-75µm and salts<70mg/m²
- Primer *Carbomastic 615MIO HBE*, 150µm DFT
- *Rustbond Penetrating Sealer* into crevices
- Stripe with *Carbomastic 615MIO HBE*
- Build *Carboguard 690 HBE* (red tint),150µm DFT
- Top Coat *Carbothane 133*, Polyurethane Venetian Red 75µm DFT

To give a total dry film thickness (DFT) of 375µm DFT.

There were a number of modifications to the specification as the project developed;

1. The time taken to apply the 150µm primer severely reduced the time in a day to abrasive blast clean. This reduced production and residual dust would fall from rough sawn timber sleepers into the slow curing heavy coating with each train movement. Therefore a holding primer of *Carboguard 504* at 50µm DFT was applied, then the stripe coat of *615MIO* was applied on completion of all the priming in a containment and finally the build coat of *615MIO* to achieve the full 150µm DFT of the prime coat.

2. The *Rustbond* was dispensed with as the crevice corrosion was not a significant problem and replaced with more stripe coats.

3. Both the intermediate and top coat required a full stripe coat of every rivet, crevice and edges in order to be able to guarantee the film builds. This was a finding on the painting of two previous riveted bridges and is a very significant additional cost.

There was a total of 15,300 L (one litre for every square metre) of paint used on the project with an average film build of about 430µm DFT. The client engaged Linetech as the third party independent coating inspector and this proved immensely valuable in ensuring the required standards were always achieved, providing significant confidence to KiwiRail.

## 7. Access

### 7.1 Span Access

The capacity of the trusses to accept transverse loads was very limited, so all wind loads had to be taken back to the top chord. This required bespoke engineered brackets to be fixed to each transom and a double truss with torsional capacity to be run between the brackets along both sides of the bridge and then double standards, also with good bending resistance, to support a twin level decked access. This provided an expensive access, but with no contact points other than at the brackets, this allowed structural repairs and coatings work to proceed without interruptions to modify scaffolding.

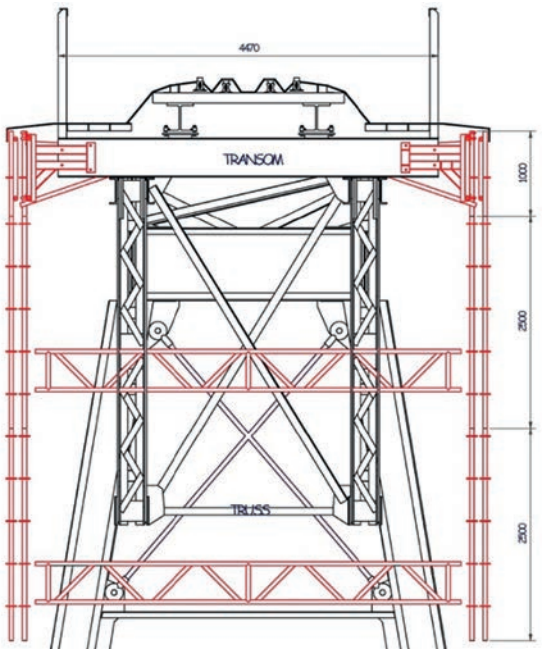


*Figure 7: Truss access scaffold cross section.*

All of the scaffolding was done using the Layher Ringlock system which proved to be very efficient, robust and strong.

**7.2 Pier Access**
The original proposal was to scaffold the two short 30m piers and use a bespoke swinging stage system to access the three taller piers. The stage system was abandoned as impractical after significant design investment and identifying that the piers had the capacity to withstand wind loads from significantly larger containments than initially advised.

The design process for the scaffolds was a significant project in itself. Each tower had bespoke footings, both concrete pads and steel beams. Beams were used when concrete foundation piers were well off the ground and where the dead weight of the scaffold needed to be transferred to the foundation to improve the resistance to over-turning of the structure in high winds.

The largest scaffold is pier six which is 76m high. It contains 270 tonnes of scaffold equipment and consumed 4,500 man-hours to build. It is fitted with a man-riding 500kg power hoist and internal access is by stairways. No ladders were used as they are unsafe especially for helmet clad abrasive blasters and inefficient when carrying materials and equipment.

## 8. Containment
One of the biggest challenges of the project was to provide a water tight rail deck between the four rails, that would withstand the expansion and contraction due to the temperature, vibration and movement of the rails with each train passing over the bridge (Figure 8). With the very regular rain this proved to be highly troublesome as the rain adversely affected the blast and painting operation, making recovery of wet spent garnet very difficult and necessitated use of a drier to recycle the garnet. It was decided to use already used garnet on wet days so if it got wet we would dump it.

*Figure 8: Water Proofing of rail deck, blasting lines on deck and blasting plant building in background.*

The bottom level of the scaffold was lined with linoleum to produce an impervious tough deck that garnet could be swept and shovelled off.

The sides of the containment were clad in 200µm shrink wrap plastic film. Our initial risk strategy for extreme wind event assumed that the plastic film would fail and therefore not damage the viaduct. Wind tunnel testing was commissioned to establish the maximum thickness of film to get failure at 100km/hr on a standard 2m x1m panel and it was found the film would not fail even at 100µm thick, which was too thin to resist mechanical damage.

A weather monitoring and cut away intervention plan was adopted but fortunately not required to be implemented as cutting would have had to be done long before the wind speed limit was reached to ensure the safety of the cutting team.

During the winter months the underside of the sleepers were lined with plywood and a second skin of film was fixed on the inside of the span scaffold to provide “double glazing” and allowed us to heat the containments to 15°C when the ambient temperature was below zero using indirect fired heaters.

The heating of the piers is more difficult as a second skin could not be fitted and the hot air rose requiring the height of the heater spaces to be reduced so we completely sealed floors every 10m to contain the heat. This all made painting through the winter much slower and more costly.

## 9. Abrasive Blasting Systems
**9.1 Blast Equipment Containment**
To allow the project to proceed all year round an abrasive blast plant building was built on a 11m x15m concrete pad. The structure was constructed from scaffold and was 8m high to allow abrasive loading by telehandler and had a lifting 8m wide door that sealed. The space was connected to the 15m³/s dust collector to control any lead containing dust from the recovery/recycling plant (Figure 9).

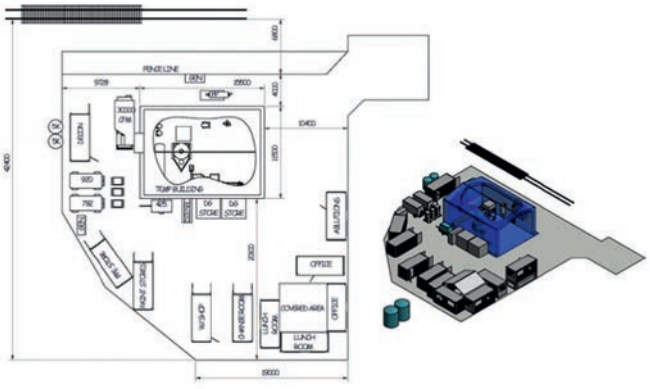

*Figure 9: Establishment Layout.*

**9.2 Air Blast Equipment**
Three air compressors supplied 1.0m³/s (2,100cfm) at up to 10Bar (150psi). Each had a separate aftercooler dryer and the air went to a 15m³ air receiver. Blast pots consisted of a four nozzle 8 tonne Megablaster which would be filled once per day and a twin nozzle large pot required two fills per day. Six blast lines were run in 50mm steel pipe along the bridge deck and 50mm hose reducing to 32mm at the operator. Most blasting was done using a No. 6 nozzle with angle nozzles used on a very limited basis.

Each of the blaster operators were fitted with radios with voice activated throat mikes and were in constant contact with the plant operator or their supervisor.

**9.3 Dust Collectors**
Two dust collectors were used on site; a larger 15m³/s (30,000cfm 100HP) at the top of the bridge and a 700mm diameter duct was run 260m along the western side of the bridge with "T's" at each pier. A second 10m³/s (20,000cfm 65HP) dust collector was placed at the base of the larger piers as ducting runs from the larger unit were getting too long. Filtration standard has 99.95% retention of particles down to 0.5µm (Figure 10).

Dust collectors ensured that the containments were well ventilated and hazardous dust was readily controlled by the negative pressure in the containments. Management of the potential risks required a rigorous programme of visual observation. The resource consent requirements were exceeded and audit reports from Horizons Regional Council stated environmental management of the project exceeded their requirements.

*Figure 10: Blast Equipment Building.*

**9.4 Abrasive Recovery**
A stationery vacuum recovery unit was positioned in the abrasive blast plant building (Figure 10). This was powered by a 150HP blower with exhaust from the dust collector also achieving 99.95% retention of particles down to 0.5µm. A 150mm duct was run the entire length of the bridge. The plant was relocated to the base of pier 5 for the lower sections of the big piers.

Gravity chutes were also used to convey the recovered abrasive down the piers with the vacuum system being used to clean the containments. A high-quality containment cleaning process was necessary as there is significant mechanical work in the containment after the blast and prime is completed. It is also necessary to clean the scaffold to the highest practical standard to minimise the amount of lead contaminated material getting into the environment when stripping the scaffold.

**9.5 Abrasive Recycling and Disposal**
The recovered abrasive was loaded into the recycler that could progress 3T/hr. The recycler initially removes gross contaminants passing through a rotating drum with a 6mm screen and then passes over an air-wash that draws off the fines and finally onto a vibrating screen with a finer mesh. Over time the abrasive gets a higher fines loading and eventually the full batch is dumped.

Blast pots were loaded with a blend of new material and recycled. On average we got around 2.5 cycles of the garnet but with wet wastage this was reduced to about 2 cycles.

The waste streams from the recycler has a proprietary leaching reduction additive manually blended into it and then when there is sufficient waste the bulk bags are emptied out into 15m³ hook-bins and fully blended using a small digger. The leachable lead is so low, the spent abrasive is then able to be dumped as non-hazardous waste at about 40% of the cost of lead containing hazardous material.

## 10. Lead Management
All of the systems developed for the project were significantly determined by the need to manage the risks associated with lead. All personnel on the project were given a baseline heath check including blood lead levels and all personnel were tested every month to monitor the effectiveness of the management systems and focus on individuals who clearly were not being rigorous in their personal hygiene. All staff were fit tested for their respirators and were issued clean overalls every day. They were required to wash their hands when leaving the bridge and smoking was banned on the work site with a controlled smoking area in the establishment area.

Abrasive blaster operators wore chest high waders and Nova blast helmets with full length sleeve blouse and gloves taped at the wrist. When it was not hot they also wore disposable Tyvek overalls with hoods over the normal overall. Decontamination was by dry air wash and wearing dust masks in the transition area. This process proved very successful. Given the cold and issues with water-pipes freezing, wet decontamination would have been very problematic.

Other trades were required to wear respirators and wear Tyvek overalls when working in the containments after blast and prime. Our greatest problems were with the mechanical team wearing the PPE, as the fitting of steel requires a lot of verbal communication with respirators being a significant impediment. Strict enforcement was instigated with the mechanical and scaffolding teams. TBS operate our own intervention blood-lead levels that are well below the statutory levels and only one person exceeded this level and was stood down. Since that event the levels on average have reduced.

## 11. Painting
Paint was applied by conventional air spray pots and guns. All surfaces were sprayed down to the smallest sections of steel. Whilst the steel plate girders have some bigger flat areas it was not sufficient to warrant using airless spray equipment.

About 60% of the painting man hours were consumed in brush application of stripe coats. As stated earlier, the stripe coating was carried out for each of the three main coats and this was essential to meet the quality standards set for the project.

*Figure 11: Inspecting Rivets for Paint Film.*

## 12. Structural Strengthening and Repair

### 12.1 Truss Strut Strengthening

The existing lattice bars on the vertical struts were removed and replaced with new plates which had access holes included for installation, maintenance and inspection purposes. The holes also ensured that the lightweight appearance of the truss remained. These plates increased the compressive capacity of the struts.

### 12.2 Truss Bottom Chords

The tension bars were installed in the bottom chords which connected into washer plates at each joint. These were tensioned up to a specified percentage of the dead load only, so as not to put the existing plate chords into compression. These bars increased the tensile capacity of the bottom chords.

### 12.3 Truss Ties

The diagonal ties used rods in the same manner as the bottom chords except special connections had to be fitted for these to transfer into the joints.

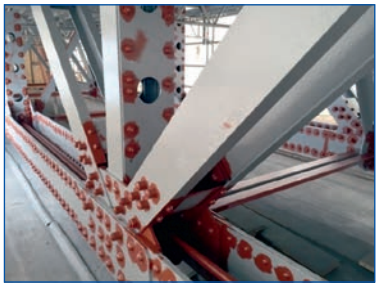

*Figure 12: Strut and bottom chord strengthening.*

*Figure 13: Tie Bracket and bottom chord washer plate.*

Figure 13 also illustrates the back of the washers up to 80mm thick used to connect the bottom chord strengthening bars. These joints were particularly difficult to install and templating was used extensively to ensure a good fit.

### 12.4 Connections at Truss Nodes

The connections were strengthened by simply adding one or two bolts as required into the joint where additional strength was required.

### 12.5 Structural Repairs

A significant number of elements were replaced, both in the towers and the trusses. This was mostly as a result of pooling water due to poor structural detailing. In particular the diaphragm plates on the inside of the pier legs had insufficiently sized drainage holes that became clogged. There were also some channels with the flanges facing up which collected water. All of this water pooling led to significant corrosion of some members.

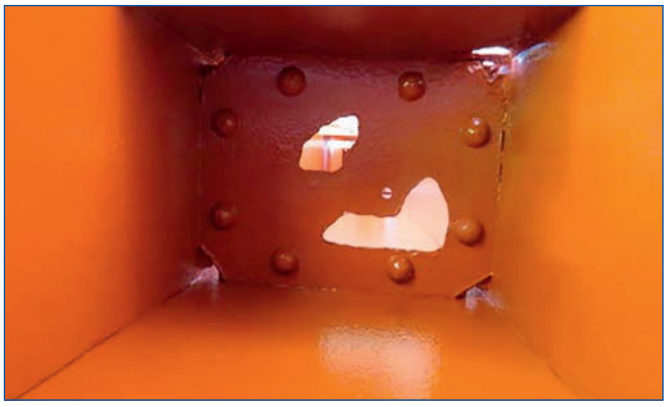

*Figure 14: Pier leg perforated diaphragm plate with sharp edges removed and painted.*

A significant number of lacing bars on the pier struts as well as batten plates on the tower legs were perforated and corroded (Figure 14). Careful structural analysis showed that there was some redundancy in the tower struts and legs, allowing many of the lattice bars and batten plates to be ground smooth and painted, rather than fully replaced. Many of the Huck bolts that were installed in 1980's required replacement with HSFG bolts as they were not galvanized and had possibly not been adequately painted at the time of installation.

## 13. Construction Challenges

The area experiences over 200 rain days per year. Keeping the deck sealed to prevent water ingress was challenging particularly considering the trains were still running over the top and vibrating free any recent attempts at sealing. Eventually a train-proof system was arrived at.

Winter conditions forced a slowdown of work on site and sometimes closure of site due to heavy snow. The encapsulation was double wrapped to form an insulation system during winter. Diesel indirect fired heaters pumped air into this system and paint continued to cure on the bridge while snow was falling outside.

Due to the limits in allowable wind loading there was careful consideration of sequencing to ensure that the area encapsulated did not put the structure at risk of toppling over. A balance of efficiency and risk acceptance was combined with contingent plans to remove encapsulation in the event of very high wind forecast.

The intricate lattice work connected by hundreds of thousands of rivets made painting difficult. A spray application would normally be the most efficient way to apply paint but the low film build produced around edges and the back of rivets has historically led to premature failure. These all had to be stripe coated by hand, three times.

## 14. Environmental Protection

The environment is a pristine National Park and strict environmental protection measures are required to keep it this way. The water quality is also important to the Whio (blue duck), the white-water specialist, who lives all year around on the river and is on the nationally endangered list.

During the early stakeholder engagement there was difficulty in assessing whether the site works planned to be undertaken would have a detrimental effect on this endangered Whio. An activity that was known to have a positive effect was the trapping of known predators of Whio such as rats and stoats. A trapping programme, implemented by DOC and sponsored by KiwiRail was developed. During the life of the project, hundreds of rats, stoats and other invasive species harmful to the Whio have been trapped. A number of Whio have been observed in the vicinity of the viaduct throughout the project

Discharge permits and land use consents were granted with the following process and monitoring programme.

Plan certifications by the regional council:

- Erosion and Sediment Control Plan
- Environmental Management Plan (EMP).
- Visible emissions assessment – Daily during blasting
- QMCI and sediment sampling for lead within river – Pre and post project
- Black disc monitoring of Makatote River during track maintenance – Weekly.

There have been no cases of non-compliance at the site and it is the only site in the region to have obtained an "exceeds compliance" result. This had had the positive effect of enhancing the KiwiRail environmental image which will make future interactions with stakeholders easier.

## 15. Safe Work and Sustainability

When the viaduct was originally constructed seven workers fell to their deaths slipping on icy steel. The designer Peter Hay got so wet and cold on one visit that he unfortunately died of pneumonia on his return journey home. He never saw the finished product.

The access standards today are vastly improved as is the personal protective equipment. A total of 130,000 man hours were consumed on the project without a single lost time accident. The project was completed in November 2016 two months ahead of programme. A detailed project management plan was prepared for the project and has been a working document. Safety is incorporated into every deliberate action on site. Every day starts with a group tool box followed by individual team job plans. Routines such as this are important. All activities were planned with detailed written work methods and job safety plans generated by the work teams to identify hazards and how to manage them.

There has been a fulltime compliance officer on the project with responsibilities including all QHSE requirements.

## 16. Conclusions

The Makatoke Viaduct refurbishment project demonstrates that an asset over 100 years old can still be relevant for a modern railway business. This is testament to the original designers and constructors. In addition strengthening and painting a large steel structure in a cold, wet and at times snowy environment is not impossible when innovation and determination are employed. The adverse effect on the environment of a project involving the removal of lead can be controlled with simple but innovative methods, As a result an environment can even be left enhanced at project completion.

Safety of staff on is achieved by a pursuit of excellence in all aspects and constant vigilance. The safe return of staff home every night is one of the targeted success factors of the project.

## 18. References

[1.] Merrifield, A. L. R., 2009. An engineering adventure 1870–1908: NZ's NIMT railway. Proceedings of the Institution of Civil Engineers: Engineering History and Heritage.162 Issue EH4. 207 – 219.

[2.] Jupp, G., 2008. Constructing the Great Makatote Viaduct: 1905-1908. New Zealand Railfan. Sep. 42 – 58.

[3.] Astwood, K., 2009 Registration report for a historic place, Makatote Viaduct.

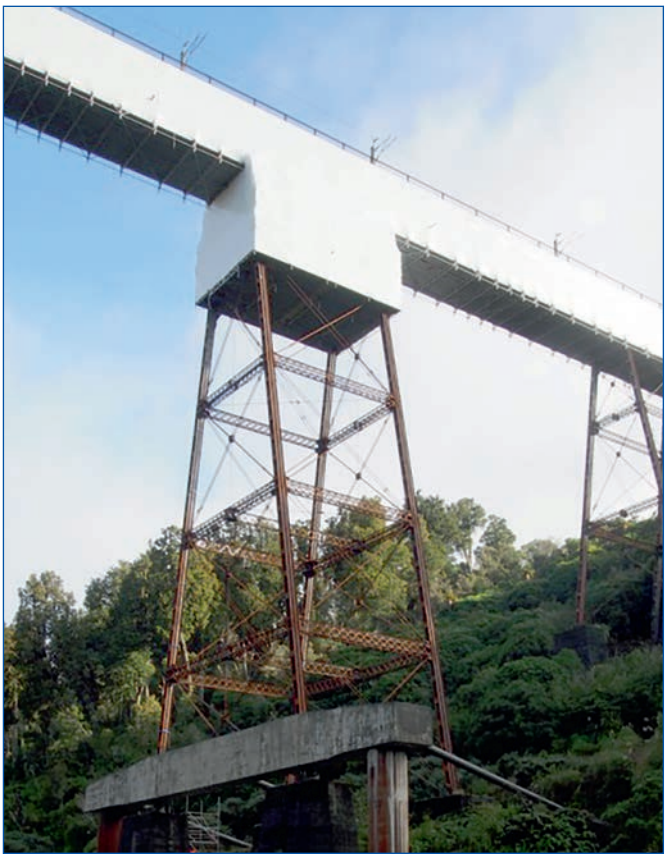

*Figure 15: Encapsulation around Pier 7.*

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