2009 Volume 6 Issue 3

HOT DIP GALVANIZING TODAY

HOT DIP GALVANIZERS ASSOCIATION Southern Africa

40

Featuring:

The 2009 Hot Dip Galvanizing Awards – Winners and Entries

An evaluation of hot dip galvanizing at a Cape Town petro-chemical plant after 25 years

Revised SANS 121 (ISO 1461:2009)

Misconceptions, On the Couch and Bob's Banter

ZINC

steel
SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

[Your galvanizer of choice]

[Robor Galvanizers boosts demand chain efficiency by partnering with you.

We are well equipped and ideally structured to quickly fulfil your order, from small projects to high-tonnage contracts that involve large fabricated components.]

Newly upgraded!

- 5000m² ~~4000m²~~ concreted lay down area added to enhance our offering
- Line 2 Kettle with a totally matched processing facility
- 4m deep • 2m wide • 10m long

Benefits to you:

- Increased flexibility
- Shorter lead times
- Increased kettle depth with fewer vertical dips
- More comprehensive service offering

Logistics capabilities include:

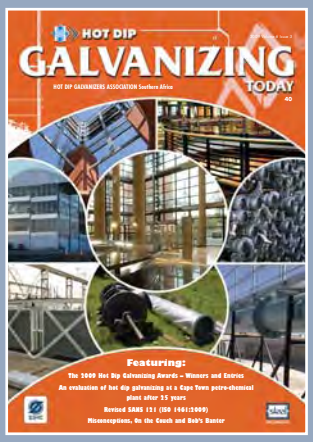
- Lay down areas
- Crane capacity
- Transport fleet

Galvanizers: +27 (0)11 876 2900

Head Office: Johannesburg: +27 (0)11 971 1600
- Cape Town: +27 (0)21 530 2580
- Durban: +27 (0)31 577 6657
- Port Elizabeth: +27 (0)41 486 1488
- E-mail: info@robor.co.za Web: www.robor.co.za

robor

Galvanizers: +27 (0)11 876 2900 • Open Sections: +27 (0)11 971 1830 • Pipe Systems: +27 (0)11 971 4300
• Precision Tube: +27 (0)11 971 1700 • Steel Services: +27 (0)11 914 2250 • Tube: +27 (0)11 971 1600



The Association is a technical information centre established for the benefit of specifiers, consultants, end users and its members

PUBLISHED BY:
Hot Dip Galvanizers Association Southern Africa
Quality House, Unit U4,
St. Christopher Road,
St. Andrews, Bedfordview
P.O. Box 2212 Edenvale 1610
Tel: (011) 456-7960
Fax: (011) 454-6304
Email: hdgasa@icon.co.za
Website: www.hdgasa.org.za

Office Manager: Saskia Salvatori
Email: hdgasa@icon.co.za

Receptionist: Marjorie Montgomerie
Email: info@hdgasa.org.za

Executive Director: Bob Wilmot
Cell: 082 325 8840
Email: bob@hdgasa.org.za

Technical Marketing Consultant: Hendrik Steenkamp
Cell: 082 891 5357
Email: hendrik@hdgasa.org.za

Editor and Technical Marketing Director: Terry Smith
Tel: (021) 797 4735
Fax: 086 612 7284
Cell: 082 893 3911
Email: terry@hdgasa.org.za

Sub-Editor, Advertising and Sales: Anne van Vliet
Tel: (011) 462-5073
Cell: 082 775 0711
Email: mwvliet@mweb.co.za

Design and Layout: Sandra Addinall
Tel: (011) 868-3408
Fax: (011) 900-1922
Email: cbtdesign@adcot.co.za

Reproduction and Printing: Camera Press
Tel: (011) 334-3815
Fax: (011) 334-3912
Email: cpress@iafrica.com

HOT DIP
GALVANIZING TODAY

Official journal of the Hot Dip Galvanizers Association Southern Africa • 2009 Volume 6 Issue 3

40

ISSN 1023/781X

CONTENTS

Front Cover: *A kaleidoscope of photographs showing the overall awards winner surrounded by the various category winners.*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment

Another year has come and gone since our 2008 awards evening. As per usual, this issue of the journal will feature all the 2009 hot dip galvanizing awards submissions.

The annual awards represents an opportunity for our member's clients; consultant engineers, project managers and architects to showcase their projects and to illustrate how hot dip galvanizing can and has been used as a superior corrosion control system. It is also an opportunity to show how Duplex coatings, being hot dip galvanizing and a top paint system, are used to combat very severe corrosive environments and at the same time improve aesthetic and architectural appearances. A sincere word of thanks to all the organisations and individuals who compiled and submitted a project for consideration by our judging panel. Without these submissions, together with our sponsors, our annual awards evening would not take place. The focus of the awards is to recognise individuals and organisations that use hot dip galvanizing and duplex coating systems, as the cost effective method of corrosion protection for the longevity of their carbon steel structures.

Every three years the European General Galvanizers Association (EGGA) organises and conducts a technical hot dip galvanizing conference known as Intergalva. The programme consists of three days of formal technical papers and two days of plant visits to selected European galvanizers. Our Association together with members are privileged, together with the other hot dip galvanizers from around the world, to participate and have an opportunity to share in all the latest developments taking place within the International Galvanizing Industry. We derive great benefit from being able to participate as we are able to remain informed and up to date on a wide range of activities. Intergalva 2009 took place during the second week of June in Madrid Spain.

All the technical papers that have been presented at Intergalva over the years are retained in our library and copies can be made available on specific subjects.

Bob Wilmot

Note from the Editor

Long term sustainability of components such as cable ladders/trays in a plant, are from experience of vital importance ensuring little or no costly future cable disruption during the service life of the plant. In fact reputable cable ladder suppliers will endeavour to ascertain the plant conditions at hand and in absence of a material/coating specification will supply what in their experience is required. The cable ladders installed in many parts of petro chemical plants such as Sasol Secunda, Petro SA (Mossel Bay) and the Caltex Refinery in Cape Town are of no exception.

Our recent evaluation of some of the hot dip galvanized cable ladders in many areas of all three of these plants show that the original hot dip galvanizing has performed remarkably well. Residual coating thickness on these cable ladders is still considerable and in fact will last for some years to come in spite of the installations being in excess of about 25 years old without any maintenance whatsoever!

It is therefore very disturbing that in spite of this proof of coating performance that certain corrosion consultants and specifiers do not acknowledge that if the coating performs well on cable ladders for these aggressive environments, that even more so (due to the almost double coating thickness achieved on most structural steel) that it will provide similar or better performance on structural steel components for projects such as these.

At the Association we pride ourselves in providing cost effective advice in the use of our coatings and are always happy to be involved in the evaluation and inspection of previously exposed and weathered hot dip galvanized or duplex coated components.

Should a reader require this evaluation and inspection service, kindly contact Bob, Hendrik or myself.

Our **feature** for this issue includes all the entries, category winners and the overall winner of the Annual Hot Dip Galvanizing Awards Event for 2009.

We publish an evaluation of the performance of hot dip galvanized cable ladders exposed to marine conditions at Caltex Refinery in Cape Town.

Education and Training, expands on our certificated coating inspectors course, an essential requirement in any coating inspectors portfolio. We include a photo of the four recipients that successfully passed the recent course in Cape Town on the higher level and invite participation to the next one in September.

The fifth part of what's important when taking coating thickness readings, is also included.

The ISO 1461 has been updated internationally and while not yet launched locally by the South African National Standards, we bring you in advance the differences between the 1999 and the 2009 version.

Other regular articles include, **Bob's Banter**, where Bob Andrew chats about '**Leaders**'.

'**On the Couch**' includes an interview with the first black empowered galvanizer, Anni Ramkisson the MD of Phoenix Galvanizing.

Misconceptions specifies C4 and C5 hot dip galvanizing for marine environments. *True or false*?

Should a reader wish to express an opinion or provide us with an article, or comment on our articles, positively or negatively, kindly contact me.

Due to lack of space '**Wamhosa**', **Coating Report** and **Guest Writer** are not included in this issue but will resume in subsequent issues.

Enjoy the 'magazinc'.

Terry Smith

2009 Hot Dip Galvanizing Awards

Overall & Architectural Category Winner

National Library

Description

The new National Library incorporates a four-storey building, including a raised public piazza leading to the entrance, hot dip galvanized steel and glass covered walkways and ramps as well as double-volume reading rooms with views onto the streets.

Location

Pretoria, Gauteng

Project partners

Client
Department of Public Works

Architects
Jeremie Malan Architects in association with ImpenduloDesign Architects and Gandhi Maseko Lingelighle

Project manager
Jeremie Malan Architects

Main contractor
Rainbow Construction in a JV with WBHO

Steelwork contractor
Maristeel

Quantity surveyors
Taljaard Meyer Storm, Lindile Mteza & Associates and Quantity Surveyors Africa

Consulting engineers
UWP Consulting Engineers, Malani Padayachee & Associates and Sintec

Hot dip galvanizers
Armco Galvanizers and Robor (Pty) Ltd – Galvanizers

Project completion date

August 2008

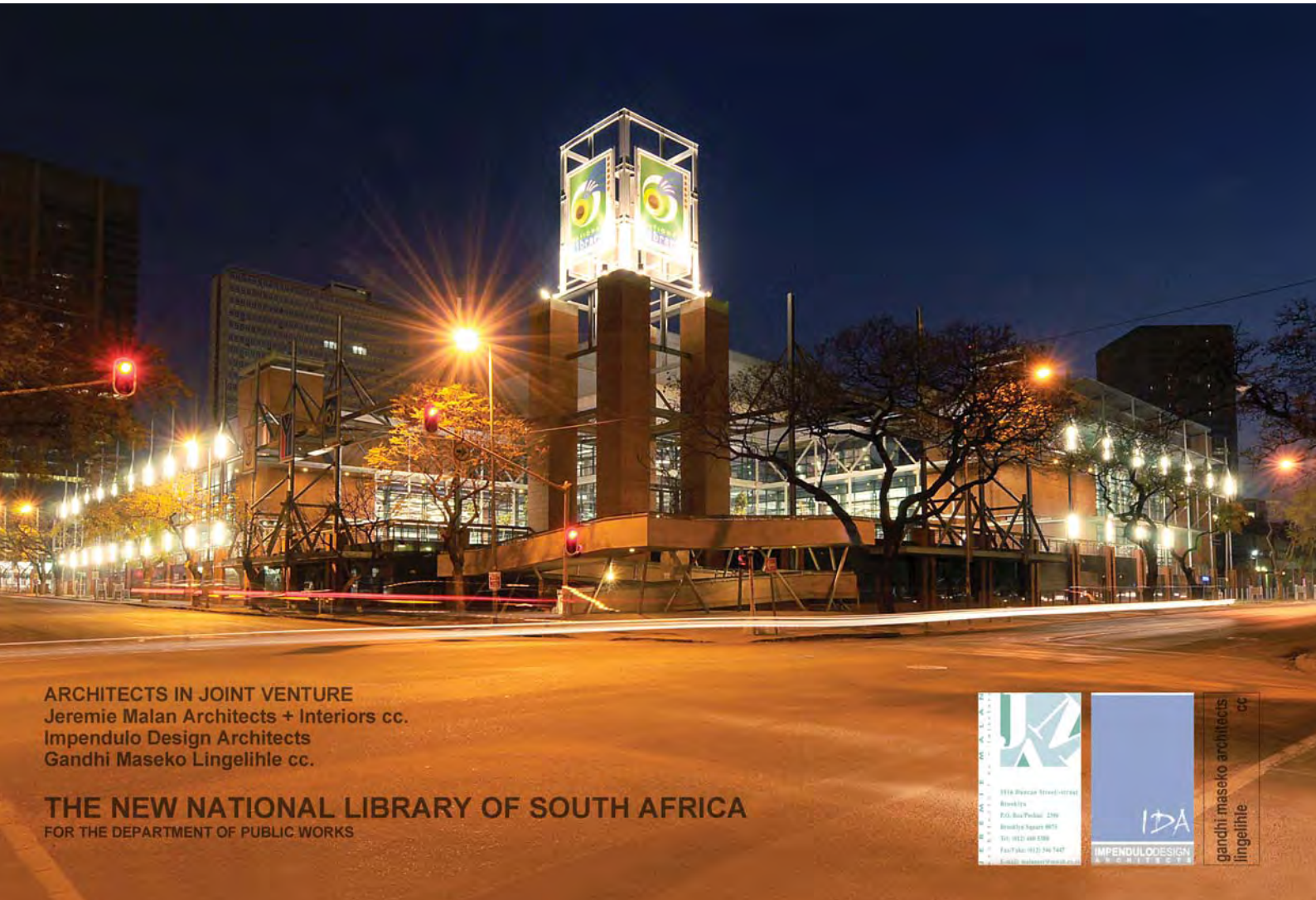
Project value

R300 million

Information

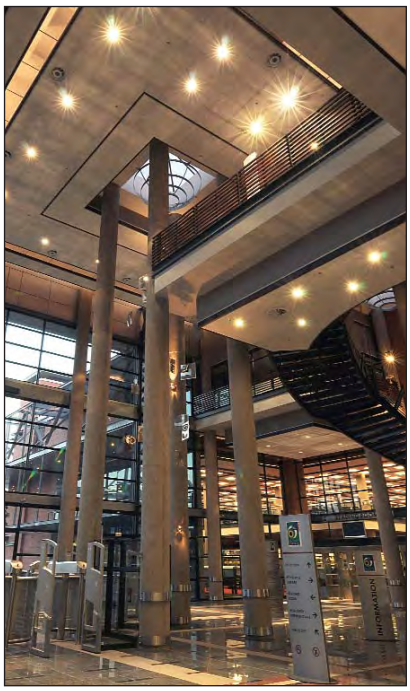
- The National Library is situated in

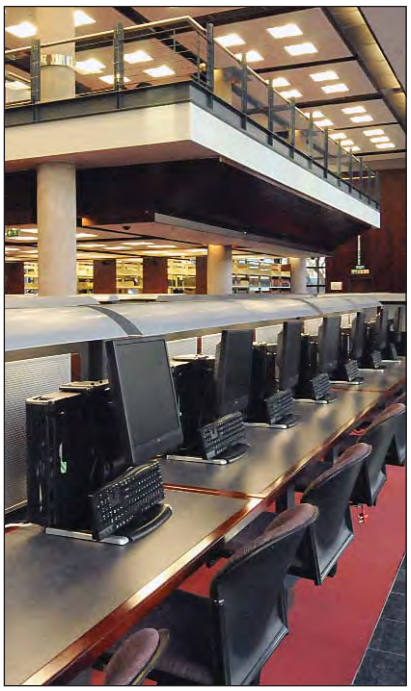
continued on page 4...



Pretoria's Central Business District on Government Boulevard and combines all the different requirements of The National Library which was previously spread over five buildings in the city.

- It is a unique, fully-funded government project to foster and revitalise education, arts and culture within South Africa.
- On 1 November 1999, a decision was made to integrate the Cape Town Library and the Pretoria State Library into a single National Library of South Africa. The Pretoria Campus (The National Bibliographical Library) and the Cape Town Campus (The Preservation Library) would make up this national library.
- The building seats 1 500 users, making its capacity 10 times that of the former library and will be able to house 3.5 million books within the next twenty years.
- The new National Library has been split into two sections; the studying section and a research section, which includes a foreign official publication section. This will allow foreign officials to access information directly from their official government publications, thereby helping to promote the library all over Africa, as an information hub of Africa.
- A new campaign was launched in 2001 to position the library as an icon for the people. This was part of an initiative called 'Masifunde Sonkwe' that aims to promote and maintain a reading culture within South Africa. This reading culture will ensure that the South African heritage and values are encouraged through all cultures and languages.
- The materials used are face brick, concrete, steel and glass, which are easy to maintain, thereby keeping these costs low. The simplicity of the materials means that the building will not age quickly.





- Existing trees on and around the property were protected and preserved, with heavy penalties imposed for any trees damaged.
- All façade steelwork is hot dip galvanized. The architect believes that part of the success of this project was due to the early involvement by the Hot Dip Galvanizers Association SA, as well as frequent meetings throughout the process.
- A further contribution to its success was that of detailed drawings by the architect, consulting engineer and shop drawings by the fabricator.
- Hot dip galvanizing was selected by the architect due to its low maintenance, sustainable long life and aesthetic appeal. Jeremie Malan describes the aesthetics in this project as the naturalness of the materials used; dark face brick versus the light colour façade. Furthermore, there is a contrast between the dark solid face brick versus the light weight hot dip galvanized façades, which are inviting and visually approachable.
- The materials were not selected because of their perfection in terms of colour – in fact, face brick, granite and hot dip galvanizing all vary in colour!
- The selected colours on this project represent the 'sand'

continued on page 6...

colours of South Africa; dark by the brickwork and granite, light to reflect the sky and the glimmer reflected by hot dip galvanizing.

- This project used the Architectural Checklist for Hot Dip Galvanizing, which was developed by the Association. This checklist was developed for the MTN Building and a visit to the MTN Head Office was a reassurance and source of favourable information prior to the finalisation of the specification.
- The correct chemical analysis of the steel with regard to silicon and phosphorus content was discussed with all parties, including Highveld Steel, and approved and added to all the consultant's drawings. However, there were instances when steel was purchased from other suppliers. The lack of availability of the specific steel was raised as a concern, discussed and resolved at a meeting attended by all parties.
- The location of this project, being in the centre of Pretoria, with extremely limited off-loading and lay-down areas presented some real problems from a logistical point of view. Selection of the crucially required steelwork, both through the fabricator and hot dip galvanizer, had some thought provoking moments!

www.bosal.co.za
www.irrigation.co.za

New Kid on the block at the HDGASA.....?

Over 50 Years International Experience in Service Excellence and Innovation

Automotive:
Supplier to OEM Market& Aftermarket

Industrial:
Precision Tube Mill
Manufacturers of Tube in Stainless Steel & Mild Steel
Enerpac
Global leader in High-Force tools & equipment
House of Irrigation
Global leader in supply of above-ground sprinkler irrigation systems

Rooibok Street, Koedoespoort Industrial Sites, Pretoria
012 391 – 1000 (Plant 1)
012 810 – 9326 (Plant 9)
bainfo@bosal.co.za

bosal

bosal ENERPAC HOUSE OF IRRIGATION

Infrastructural Development Category Winner

Bosal House of Irrigation

Description

An export order of a hot dip galvanized irrigation system for two privately owned sugar estates.

Project partners

Supplier
Bosal House of Irrigation

Hot dip galvanizer
Phoenix Galvanizing (Pty) Ltd

Tons of steel

350 tons

Project value

R7.5 million

Information

- Bosal Afrika is comprised of various divisions, one of which is House of Irrigation (HOI). HOI supplies a diverse customer base around the world and produces above-ground sprinkler irrigation equipment and manufactures 'quick coupling' irrigation pipes in either galvanized lightweight steel or aluminium.
- Bosal Afrika consolidated the House of Irrigation, closed down their in-house hot dip galvanizing plant and entered into a long-term arrangement with Phoenix Galvanizing for their galvanizing needs.
- At the end of 2008, Bosal HOI received an enquiry for an export order for two privately owned sugar estates that had a planned 4 000 hectare expansion. The order equated to roughly 350 tons, a sizeable portion of the

company's annual production on the HOI Division. Conscientious planning needed to be put in place to ensure a smooth execution without compromising any of the groups other business units.

- The tube aspect of the order encompassed the fabrication of 65 000 metres of tubing, with the production and execution of the order being planned in accordance with the shipping dates.
- Tubing is not the only component to the product and all fittings and pipes are produced in-house at Bosal's plant. All mild steel irrigation products are hot dip galvanized as most of the equipment is exposed to the elements and in contact with the soil. Failure of the product is costly from a maintenance point of view.
- Alternatives to hot dip galvanized irrigation products are available in the form of aluminium, however, aluminium products leave a larger carbon footprint due to the energy consumed in making such products.
- The supply chain begins with the transportation of the components to Durban and the galvanizer increased their fleet schedule in order to meet Bosal's supply programme. An arrangement was also made to leave empty trailers at Bosal's plant to facilitate loading.
- As a value-added service, Phoenix Galvanizing cleaned and reworked the pipes and fittings after hot dip galvanizing. When dipped in the molten zinc, many of the hinges and moving parts can seize once the zinc solidifies. These fittings need to be fully functional for installation.
- Since the product was shipped via Durban, the galvanizer stored the product in the yard. Phoenix Galvanizing also containerized the product, with key Bosal staff overseeing this process.
- Hot dip galvanizing is usually associated with industrial buildings and architecture. This project illustrates the use of the coating in the agricultural industry, which is experiencing growth due to increased pressure to produce crops, not only for food but other commodities such as bio-fuel.

Duplex Coating Systems Category Winner

Potsdam Wastewater Treatment Works Settling Tanks

Description

Duplex coating applied to steelwork for protection against an extremely harsh environment for the Potsdam Wastewater Treatment Works Settling Tanks.

Location

Koeberg Road, Western Cape

Project partners

Owner
City of Cape Town

Consultants
Africon / Ninham Shand / Asch Consulting Engineers Joint Venture

Technical project manager
Chris Little

Main contractor
Inenzo Water

Hot dip galvanizer and paint applicator
Galvatech (Pty) Ltd

Tons of steel

±10 000kg / Bridge – 4 Bridges

Project inception date

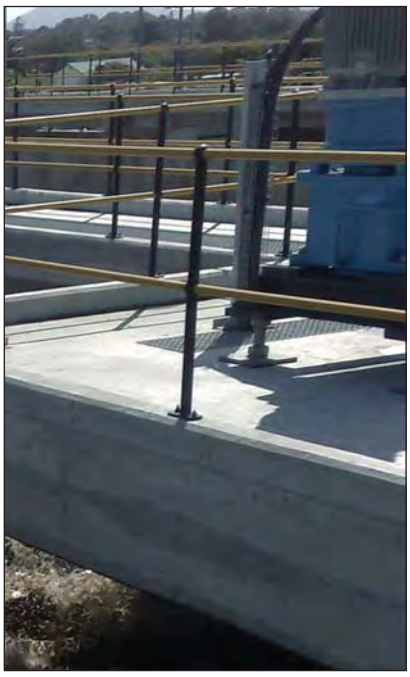
January 2008

Project value

R6.6 million

Information

- The project consisted of designing new bridges for the Potsdam Wastewater Treatment Works and providing a protective coating in an extremely corrosive environment. A duplex coating system consisting of hot dip galvanizing and a suitable paint system was specified.
- Galvatech and Inenzo Water held meetings during the fabrication stages to ensure the minimising of delays during the hot dip galvanizing process. Adjustments such as venting and drain holes were made to the components.
- The proactive discussions between the galvanizer and the client and the fact that the components complied with SANS 14713, ensured a quality hot dip galvanized coating.
- The quality of the fabrication allowed Galvatech to ensure a quick turnaround time. Although SANS 121 specifies a mean coating thickness of 85 microns, consistent readings were taken, measuring between 100 and 150 microns.
- Once cured, the components were transported to the Potsdam site. The bridges were lifted by an overhead crane onto trucks with slings and not by forklift to ensure reduced coating damage.



- These bridges are difficult to maintain as they are partly immersed in the settling tanks and operate for extended periods of time. Therefore a coating with the longest life expectancy, with little or no maintenance was required. Although a duplex coating system was more expensive, taking into account its durability, resistance to abrasion, ease of inspection and low maintenance costs, makes a duplex system more beneficial.
- This project improved the ongoing relationship between the galvanizer and the fabricator in numerous ways. Apart from Galvatech's own internal inspections, quality control was performed by a third party inspector at different stages of the application, ensuring a good quality product.
- Communication between Galvatech and Inenzo Water increased and slight adjustments were made to the administration process. Drawings of all components were sent to the galvanizer beforehand.
- By delivering an efficient service and a quality product, the galvanizer and the fabricator have ensured that both their existing customer, as well as new customers, will continue to use them. Once a client is able to trust their sub-contractors, they will very seldom change their chain of supply.

Mining and Industrial Category Winner

Steam Condensing Radiator

Description

The hot dip galvanizing of three 5-ton steam condensing radiators

Project partners

Customer / end user
Extractive Technologies

Project manager
Frigotherm (Pty) Ltd

Hot dip galvanizer
Robor (Pty) Ltd – Galvanizers

Tons of steel

5 tons per unit

Information

- Frigotherm Engineering was founded in 1973 by a small group of thermal engineers, with a simple philosophy of satisfying the customers' requirements by providing suitable products through expert knowledge and advice.
- Over the years they have designed approximately 30 heat exchange products and supply the entire spectrum of 'heavy industry' in South Africa, of which an essential part is radiators.
- Frigotherm specify hot dip galvanizing as their corrosion protection system where appropriate due to its metallic bond and heat transferring bridge between the initially loosely assembled parts of the radiator such as tubes, fins and spirals.
- As such, the galvanizing process is not only used as corrosion protection, but also as a vitally important heat transfer mechanism and improved thermal efficiency.
- Using hot dip galvanizing as the corrosion protection system enables Frigotherm to manufacture their radiators from carbon steel, which results in an extremely robust product, particularly well suited for the mining industry.
- A further advantage to their production process is that entire batches of semi-finished radiators can be hot dip galvanized in a single dip, resulting in considerable time saving, thereby increasing efficiency and cost effectiveness.
- In this particular project, three steam condensers were commissioned for installation in Sasolburg. These steam condensers are used to heat up large volumes of air and weigh five tons each.
- The hot dip galvanizing of these condensers was extremely challenging due to their size and the fact that these were to be galvanized externally only as

condensing steam is circulated inside the radiator.

- The Archimedes principle played a role in the hot dip galvanizing of these condensers, which states that any object, wholly or partially immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object. Thus, among submerged objects with equal masses, objects with greater volume have greater buoyancy.
- Zinc is seven times more dense than water, so a special jig was designed by Robor Galvanizers, which included a super-imposed weight required to overcome buoyancy and immerse the condenser into the zinc.
- The hot dip galvanizing of these large condensers was made possible due to the 10m long and 4m deep galvanizing bath at Robor Galvanizers.
- A 'snorkel' was inserted at the top of the condenser in order to help release the pressure which is caused by steam.
- The successful hot dip galvanizing of these condensers has the potential to extend the use of the process to many other large components that are required to operate in corrosive environments and / or rough handling conditions.

Community Development Category Winner

Reichenau Mill Restoration Project

Description

The restoration of the Reichenau Mill

Location

Bulwer

Project partners

Project co-ordinator
Peter Frow

Hot dip galvanizer
Phoenix Galvanizing (Pty) Ltd

Information

- The Reichenau Mill, which forms part of the Reichenau Mission Complex, is situated on the Polela River, a few kilometres beyond Bulwer. It was constructed by Trappist monks around 1896 and is a wonderful example of late nineteenth century mill engineering being driven by water power from the adjacent river, which descends some 40 feet over a picturesque waterfall upstream of the mill.
- Phoenix Galvanizing was asked to provide the hot dip galvanizing for free and on realising that this was not a disorganised venture, Phoenix Galvanizing became an official sponsor of the Reichenau Mill Restoration Project
- The power in the water was harnessed by means of an axial-flow multi-bladed turbine situated at the base of the waterfall. Water was conducted along a channel or headrace drawn from a weir upstream of the waterfall.
- The turbine, which weighs approximately 2 tons, had a power output of about 50 horsepower. It transmitted its power to the mill situated at the top of the waterfall by means of a steel cable passing over two large pulleys.
- After milling for some 90 years, the turbine house was carried away by floods in 1987 caused by Cyclone Desmoina and heavy rainfall over the same period. The turbine remained hanging by its pipe work, but the intermediate layshaft was gone, so the mill became unusable.
- When the foundations of the turbine were constructed in 1885, the practice at the time was to use very little cement and to rely on the weight of the masonry to secure the structure. This worked for 90 years, but the floods of 1987 were so severe that the large foundation stones were dislodged below the water and eventually the entire tower collapsed.
- A farmer who was leasing the Reichenau farm at the time retrieved enough of the masonry from the river which enabled him to reconstruct the foundations and to cast a concrete slab at the level of the timber turbine bearers.
- At the beginning of 2007 a small group of enthusiasts began restoration work on the mill believing that it represented a priceless cultural and historic asset. This group had the benefit of the foundation laid by the farmer and had to determine how to anchor the tower to the foundation.

- Peter Frow is a Mechanical Engineer and Industrial Designer. His wife, Jill, taught a group at the Reichenau Mission and Peter accompanied Jill on one of her trips. With his keen engineering background he started exploring the old buildings and found the old mill, which had stood in disrepair for nearly 20 years.
- Peter, along with a group of very experienced retired volunteers started the restoration process, much to the misgivings of the powers that be, who were naturally very suspicious of this group and their intentions.
- Although the atmospheric conditions are not too corrosive, the team wanted the new components to be a tribute to the longevity of this national treasure, particularly since the original mill construction was of such a high standard.
- A hot dip galvanized steel tower was built to replace the old turbine house. The main purpose of this tower is to support the intermediate layshaft. The new steel tower was designed with "hints" of Victorian elements to allow it to blend with the old architecture.
- The tower sits on the new hot dip galvanized steel bed-frame, which replaced the old timber frame.
- A few other components in the turbine were also replaced with hot dip galvanized steel components, including the tailpipe (which is submerged in water) as well as the end-bearing pedestal (which is also exposed to the elements).
- Once the mill is complete and in working order, the team aims to tackle the rest of the mission comprising of various other buildings, including a German engineered cathedral. The main objective of the operation is to promote tourism, educate and to become a commercial mill.
- All revenues derived from the mill are to be used for the ongoing restoration work at the mission.
- Although the buildings at the mills are over 100 years old, many of the steel parts were severely corroded and could not be salvaged in the restoration process. These were replaced by hot dip galvanized steel parts.
- Original wooden parts were innovatively replaced by steel components.
- A vast amount of knowledge was gathered and transferred. Precious artefacts (actual plans of the mill as well as several precious photographs and other historical treasures) were gathered from various sources and preserved for future generations.
- When restored, the Reichenau Mill will be one of the oldest water-driven mills in Southern Africa.

Export Category Winner

Moroccan Grand Prix

Description

The off-site manufacturing and hot dip galvanizing of 20 moulds for concrete crash barriers, debris fencing panels, three-storey control tower, two-storey pit structure with VIP suites, over-track gantry for start lights, starter stand for controls and demarcation brackets for crowd control.

Location

Marrakech, Morocco

Project partners

Owner
Menara Group

Track Design
D3 Motorsport

Fabricator
Steelcom Engineering

Hot dip galvanizer
Phoenix Galvanizing (Pty) Ltd

Tons of hot dip galvanized steel

700 tons

Project inception date

End 2008

Information

- Steelcom is a Durban based engineering firm who supplied fencing for the A1 Grand Prix, which was hosted by Durban in 2005 and 2007. During this time the company established a firm relationship with Australian based D3 Motorsport as supplier. When the Moroccan Grand Prix, which was last held in 1953, became a reality, D3 Motorsport employed the services of Steelcom.
- The structure is located in an area that is not highly corrosive; therefore the corrosion protection properties of hot dip galvanizing ensure a quality product which is maintenance free for many years to come. However, hot dip galvanizing provided corrosion protection whilst the goods were in transit. Goods were shipped from Durban to Cape Town to Algiers and then to Casablanca. Containers spend an average of six weeks on the water and more time on the docks, both of which are highly corrosive areas.
- D3 Motorsport was happy with the aesthetic finish of the hot dip galvanizing and decided not to apply a paint coating.
- The final product is a magnificent high-tech steel and glass structure rising from the barren landscape. It is in stark contrast with the red desert sand, framed by the majestic Atlas Mountains in the background.
- The project is very novel in the sense that the complete structure (except foundations) was manufactured remotely and then assembled on site.
- The hot dip galvanizing of this particular structure shows growth in the motorsport industry – many items of steel were hot dip

galvanized for the A1 Grand Prix, which was held in Durban for three years and is now being hosted by Gauteng.

- Constant transfer of knowledge occurred. Problems relating to galvanizing were communicated, brainstormed and resolved in order to ensure a high quality product.
- The project faced many challenges, particularly that of extremely tight deadlines.
- Other than hot dip galvanizing, Phoenix Galvanizing provided many added-value services to Steelcom, such as the transportation of goods from the client, stacking and securing in custom made shipping pallets, storage and provision of under-cover working areas for Steelcom and the containerizing of 69 containers from their yard.
- Steelcom was further involved in the erection of the project in Marrakech, Morocco. General feedback from D3 Motorsport is that they were extremely happy with their South African supplier and the quality of the hot dip galvanized coating.
- At the actual event there were delegations from three different European countries who observed the event and infra-structure for implementation in their own country via D3 Motorsport. With the success of this project, Steelcom is a natural contender as a future supplier.

Nelson Mandela Museum Qunu, Eastern Cape

ARCHITECTURAL CATEGORY ENTRY

Description

A museum built in the former Transkei to honour South Africa's first fully democratically elected President, Nelson Mandela. This entry discusses the major building complex – Qunu.

Project partners

Developer/owner	Department of Public Works
Architect	Architects in Association
Specifier	HHO Africa Infrastructure Engineers
Project manager	Architects in Association
Main contractor	Transtruct Construction
Steelwork contractor	ISG Engineering
Hot dip galvanizers	Galvanising Techniques and Morhot (Pty) Ltd
Inception date	November 2001
Completion date	September 2006
Project value	R22 million

Information

- To honour South Africa's first fully democratically elected President, the Department of Public Works was tasked to build a museum complex in the former Transkei. The building complex at Qunu together with buildings at Mveso and Mthatha, form the Nelson Mandela Museum.
- Each museum site showcases different periods in the life of Nelson Mandela. Mveso, situated in the Mbashe River valley commemorates his birthplace. Qunu is the major building complex and as it was the place where Nelson Mandela started his schooling, it has an education theme. The Bungu Building is in Mthatha and houses the exhibition items depicting his adult life.
- As one enters the complex, the main canopy structure, shaped like a giant wing, gives one a sense of openness, yet integration. Furthermore, there is a first class restaurant and exhibition hall, both with splendid views. Dormitory accommodation for school children, a sports hall and a dining room complete the Information Centre.
- Nelson Mandela has a love for children and gardening, education is close to Mandela's heart and these amenities allow children to experience the beauty of the countryside, learn some of our history and study. The garden area allows the children to learn and practice horticulture.
- There is also a community hall and two buildings for the local manufacturing of items for sale to tourists, which will bring income into the village.
- The very attractive architecture, making use of exposed hot dip galvanized structural steel, shows the versatility of steel as a building material.
- With the steelwork exposed, a durable corrosion coating was essential. During the design process, painting was first considered but continual maintenance was not an option.
- Hot dip galvanizing was then considered, but the architect did not like the 'speckled' finish. A zinc metal spray with a sealing coat was finally specified in the tender. However, when the contract was awarded, the main contractor motivated a change from zinc metal spray to hot dip galvanizing as he was having difficulty with the availability of zinc metal spray in the Eastern Cape.
- The advantage of the hot dip galvanized coating was that this could be done off site and transported to site and because of its durable finish; it would not be damaged during handling.
- This project created opportunity for local people to use their skills and earn an income, both through the stone work and the handcrafting of cupboard doors and lampshades made from

galvanized sheet. The diversity of skills was not just confined to these two areas – the timber which is used to fill in the four quadrants created by six steel columns, has been decorated with carvings created by artists from the Eastern Cape.

- To provide potable water to the museum, a borehole was sunk near the complex and water is pumped to an elevated hot dip galvanized reservoir. From here water flows to the various buildings, thereafter the waste water flows downhill to a treatment plant which cleans the water to DWAF standards for release back into the streams. It is also used to irrigate the gardens and storm water collected from the roof is piped to a small dam.
- The hot dip galvanizing now has a uniform colour which is very satisfying from an aesthetic perspective and most importantly, will protect this building from corrosion.

DUPLEX SYSTEMS CATEGORY ENTRY

Table Bay Hotel V & A Waterfront, Cape Town

Description

The application of a duplex coating system to all structural steelwork at the Table Bay Hotel

Project partners

Owner	Sun International
Architect	Louis Karol
Engineer	Louis Karol
Steel fabricator	Steel Art
Main contractor	Murray & Roberts
Hot dip galvanizer and paint applicator	Cape Galvanising (Pty) Ltd
Tons of steel	±50 tons
Inception date	1996
Completion date	1998

Information

- The magnificent Table Bay Hotel is situated within 100 metres of the Atlantic Ocean and 50 metres from the water of the Cape Town Harbour.
- All the external steelwork was hot dip galvanized and painted. The hot dip galvanizer's responsibility ended with the galvanizing, which was unpassivated, which is standard practice for galvanized steel which is to be painted.
- The steel fabricator was to be responsible for applying the primer and a paint contractor was employed to apply two final coats on site.
- Regrettably the paint contractor did not sufficiently clean the steelwork before applying the paint after the steel had been on site for three months and had become contaminated with chlorides and dust.
- Cape Galvanising informed the contractor that it is much safer to apply a duplex system in a controlled environment. This was an education opportunity to illustrate how important it is to ensure the steel is clean before applying paint.
- The steelwork was stripped and re-painted in the paint shop of Cape Galvanising.
- All the external columns and roof steelwork at the drive-in entrance and the glass and steel main entrance to the hotel has been duplexed coated.
- The duplex coated steel columns provide decoration and support for large glass areas allowing for a panoramic view. Rooms facing the Atlantic have duplex coated steel balconies. Furthermore, the car park has steel lighting poles which were duplexed by Cape Galvanising some 14 years ago. The original coating is yet to be replaced.
- The Table Bay Hotel perfectly illustrates the point that duplex systems which are applied correctly can be used for high profile architectural projects that require long term corrosion protection.
- It also shows that duplex systems are essential in aggressive marine environments as all the steelwork in this project is still in pristine condition.

DUPLEX SYSTEMS CATEGORY ENTRY

Sweet Valley Primary School Constantia, Western Cape

Description

A duplex coating system for an in-door swimming pool at Sweet Valley Primary School.

Location	Constantia, Western Cape
Project partners	
Client	Sweet Valley Primary School
Main contractor	Holing Projects
Engineer	Ross Holing
Hot dip galvanizer and paint applicator	Cape Galvanising (Pty) Ltd
Tons of steel	38 tons
Completion date	2008

Information

- The Sweet Valley Primary School Committee made the decision to offer year-round swimming to its pupils. It was then that a suitable corrosion protection system for the building, which had to be erected to protect the pool, was discussed with the contractor.
- An indoor swimming pool is a very corrosive environment for steel structures because the relative humidity remains very high and the steel remains 'wet' for extended periods of time.
- This time of wetness combined with the chlorinated salt or chlorine can be extremely corrosive. Cape Galvanising recommended that for aesthetic reasons and for extra corrosion protection, the client use a duplex coating consisting of hot dip galvanizing, an epoxy primer and a polyurethane top coat.
- The hot dip galvanized coating thickness averaged about 145 microns of zinc on the structural steel. The galvanized steel was chemically cleaned and thoroughly water rinsed. A paint system was then applied, resulting in a total coating thickness in excess of 245 microns.
- Hot dip galvanized steel that remains wet permanently has a dark colour and will most likely have areas of white rust (zinc hydroxide), therefore a duplex system offered an attractive, brighter finish over and above the lifetime expectancy well in excess of 25 years.

EXPORT CATEGORY ENTRY

Sassi Design Angola

Description

Showroom, workshop, stores and administration building for John Deere in Angola

Project partners

Developer/owner	Agromundo (Angola)
Architect	Sassi Design
Specifier	John Deere
Project manager	SvL Engenharia (Luanda)
Main contractor	SvL Engenharia (Luanda)
Hot dip galvanizer	Armco Galvanizers
Tons of Steel	20 tons
Inception date	August 2008
Project value	± R6 million

Information

- Building-In-A-Box is a South African product designed and engineered to offer an innovative approach to construction. These steel structures are pre-cut in the factory to a customary design and can be used for commercial and residential projects.
- It makes use of a unique Organic Portal System which enables Sassi to offer structures that have been developed from foundation upwards. This simple construction dramatically reduces time and financial costs.
- One of its critical factors is the huge amount of flexibility which means that expansion and redesign is made possible, both in urban and rural areas. Furthermore, due to the portability of the components, they are easy to transport.
- Until now, the product was only offered with a painted finish. However, due to damages during transport, hot dip galvanizing has now been introduced as the preferred finish. This not only adds to the product's durability during transport, it is also more cost effective to galvanize in terms of maintenance costs and extends the life of the product.
- This project for John Deere is the first in Luanda, with many new enquiries being handled for seven story hotels, parking garages and several factories.
- Due to the low skill level required during erection, this concept creates numerous job opportunities as well as transferring knowledge and training to unskilled locals.
- Hot dip galvanizing provides a uniform finish, which adds to the product's appeal.

MINING AND INDUSTRIAL CATEGORY ENTRY

Lorbrand / DRA DMO Middelburg

Description

Hot dip galvanizing of conveyor idlers and frames

Project partners

Developer/owner	Lorbrand / DRA DMO
Project manager	Raymond Chown
Architect	Jim
Hot dip galvanizer	Armco Galvanizers
Tons of steel	380 tons
Inception date	17 November 2008
Project value	R12 766 147.00

Information

- Lorbrand is world recognised for its high quality and unique design of roller idlers and have supplied conveyor systems around the world.
- This over-land conveyor is designed to bring the valuable coal from the mine to its final destination. Once the conveyor is in operation, stoppage time costs the mine; therefore a very high standard is expected by the customer.
- Although this is not a new application, it has a proven track record. Lorbrand has changed the angle of the conveyor from 45° to 90°.
- The customer and Lorbrand do intensive quality inspections, with the galvanizing process being closely monitored – from loading black steel on the trucks, delivery to the galvanizing plant, right through to loading the finished product for shipment.
- A huge amount of care and attention was given to deliver a quality product, for example each item was palletised, strapped and wrapped for delivery.
- This project was completed in record time due to the precise planning of the fabricator and quick turnaround time on the part of the galvanizer.
- Hot dip galvanized components are protected from both the harsh environmental and physical conditions which are found in the mining industry. In addition, hot dip galvanized conveyors need little or no maintenance.

MINING AND INDUSTRIAL CATEGORY ENTRY

Workshop at Klipspruit Coal Mine Ogies, Mpumalanga

Description

The building of a full workshop at the Klipspruit Coal Mine

Project partners

Engineer/architect	Goba (Pty) Ltd
Specifier	BECSA
Project manager	Tass Engineering
Main contractor	Radon Projects
Fabricator	Tass Engineering
Hot dip galvanizer	Armco Galvanizers
Tons of steel	700 tons
Completion date	April 2009
Project value	R25 million

Information

- Tass Engineering is building a full workshop, tyre repair, fitment and wash bay for the large dump trucks at the Klipspruit Coal Mine in Ogies.
- This is part of the construction of a 16 million ton per month coal washing facility, which is a 50:50 joint venture with Anglo Coal.
- A process plant, with stockyard and materials handling system will be part of the project.
- Due to the corrosive properties of the soil at the mine, hot dip galvanizing was selected as the corrosion protection system.

INFRASTRUCTURAL CATEGORY ENTRY

Ground Based Global Positioning Systems (various locations)

Description

Ground based global positioning systems for Air Traffic Management Systems (Doppler Effect)

Project partners

Developer/owner	SAAB Grintek
Project manager	Tass Engineering
Main contractor	Grintek
Hot dip galvanizer	Armco Galvanizers
Tons of steel	15 tons per unit of structural steel
Project date	2007 – 2009
Project value	±R35 million

Information

- Tass Engineering has grown to become one of South Africa's leading structural engineering companies and has considerable experience in private sector construction work.
- For the communication networks of Telkom and Eskom, they have specialised in the construction and erection of self supporting structural steel towers throughout South Africa, as well as a rural telecommunications network in Swaziland.
- Work specifically undertaken in the Air Traffic Management Arena includes the design, supply, fabrication, delivery and erection of 3m and 5m hot dip galvanized DVOR's at Cape Town International, Oribi, Polokwane, La Mercy, Gabarone and Greytown Airports.
- CVOR's have been fabricated, hot dip galvanized and erected at OR Tambo International Airport, Kimberley, Welkom, Petrusville, Sishen, Victoria West, Mafikeng, Tanzania, Warden and Sutherland.
- Tass have designed, supplied, fabricated and hot dip galvanized antenna rings for the OR Tambo International Airport and in Kilimanjaro.
- The DVOR / CVOR system is an international standard for short term navigation, providing bearing information to pilots. It offers improved performance for locations with unfavourable terrain conditions, owing to a wide-aperture antenna system and utilisation of the Doppler Effect.
- Hot dip galvanizing provides a long term, corrosion free life to these products, with little or no maintenance required.

COMMUNITY DEVELOPMENT CATEGORY ENTRY

Eshowe Taxi Rank Eshowe, KwaZulu Natal

Description

The manufacture and hot dip galvanizing of the structural steelwork for the Eshowe Taxi Rank

Project partners

Developer/owner	Umlalazi Municipality
Project manager	UWP Consulting (Pty) Ltd
Architect	UWP Consulting (Pty) Ltd
Main contractor	Matriarch Contractors cc
Steel fabricator	Steelcon
Hot dip galvanizer	Bay Galvanizers
Tons of steel	20 tons
Project date	February 2007
Project value	R3 million

Information

- The Eshowe Taxi Rank is an immeasurable help to commuters in order to simplify their lives. Commuters using the previous taxi rank were exposed to the elements and a great amount of inconvenience.
- The rank is easy on the eye and blends in with its surroundings.
- In order to create a functional rank, which operates 24 hours per day and seven days a week, it has to be maintenance free. By using hot dip galvanizing as the corrosion protection system, this goal is achieved.
- Due to the highly corrosive atmospheric conditions of the Kwazulu coast and exposure to carbon emissions, it was vital to specify a good corrosion protection system.
- The trusses appear curved or rolled into an arch form but are in fact made up in straight pieces and assembled in such a manner that it displays itself as arched.
- The trusses were spliced for easy transportation and facilitated efficient hot dip galvanizing.
- The client was educated on various issues such as using the correct product to repair welds and coating damages and using hot dip galvanized bolts on the joints of the trusses rather than electroplated bolts.
- This project represents potential for expanding, specifically for this type of category, which is an integral part of many South Africans.

COMMUNITY DEVELOPMENT CATEGORY ENTRY

Bisi Pedestrian Bridge Umzimkhulu, KwaZulu Natal

Description

The hot dip galvanizing of a pedestrian bridge in Bisi.

Project partners

Developer/owner	Department of Transport, KZN
Project manager	Junaid Kathrada
Architect	VNA Consulting (Pty) Ltd
Main contractor	Erbacon Construction (Pty) Ltd
Steel fabricator	Steelcon
Hot dip galvanizer	Bay Galvanizers
Tons of steel	30 tons
Project date	October 2007
Project value	R4.3 million

Information

- The province of Kwazulu Natal is continuously looking for ways to improve the lives of their community, in a cost effective way.
- The Bisi Pedestrian Bridge was created to establish a safe and simple crossing for the people from the local villages. This specific point over the river was chosen due to the unfortunate fact that many children had drowned here as this was the closest river crossing to their school.
- Hot dip galvanizing was selected as the corrosion protection system for the structural steelwork due to the fact that the bridge will be continuously exposed to the elements as there are no mountains, trees or any protection from the wind and rain.
- This bridge is located in an area that is not easily accessible with an ordinary vehicle and therefore has to be maintenance free. Furthermore, it has to be safe as many school children, pensioners and locals will be using it on a daily basis.
- Hot dip galvanizing is frequently specified for these structural steelwork pedestrian bridges,
- Although the bridge was erected in the less rainy season, the river pushes high up on the banks, causing potential corrosion issues. After a heavy rainfall, the water runs down the mountain and accumulates around the site. The soil is clay, which can be very acidic.
- Erecting this bridge was a combined effort of an established contractor in joint venture with an emerging BEE contractor.

Bob's BANTER!

Statemanship and business leadership have much in common

The conventional definition of a manager is someone who gets work done through others. Is it as simple as this? Harry Truman's definition may be more realistic: *'a manager is a person who gets people to do things they don't want to, and enjoy it'*. How people are treated appears to be the key to getting people to work. Is this why more emphasis is now being placed on 'leadership' rather than on 'management'?

There are many differences between a manager and a leader: a leader focuses on people while a manager focuses on systems and structures; leaders inspire trust while managers rely on control; leaders innovate while managers administer; leaders motivate while managers instruct and leaders encourage development while managers seek immediate solutions. But is this not being overly simplistic? What is the essence of leadership? John Kenneth Galbraith had a meaningful understanding of leadership when he said that the sole characteristic of all great leaders was 'their willingness to confront unequivocally the anxieties of their followers'.

Many political leaders and statesmen would agree with Galbraith. Mandela, Gandhi and Churchill, to name a few, spent their entire working lives addressing the fears and concerns of their followers. Does this apply to business leaders? Do they confront unequivocally the anxieties of their followers, i.e. their employees? They certainly do for their company's shareholders, but are the shareholders their only followers?

It would appear that political leadership is not the same as business leadership, if we are to follow Galbraith's definition. Why can it not be the same?

In the modern business environment, especially in South Africa, there has to be a fine balance between satisfying the expectations of shareholders and employees.

Shareholders, quite rightly, expect a good return on their monetary investment; they will invest elsewhere if they don't receive it. Similarly, employees expect a get a good return on their investment of time, intellectual capacity and labour. They, too, will go elsewhere if they don't receive it. If there is nowhere else to go, however, they will stay, but will become frustrated and despondent.

Business leaders know very accurately what sort of return their investors require; they spend a great deal of time reading the financial literature to find out. They employ accountants to calculate and assess optimum returns on investment for their investor clients. They know exactly how to keep their investors happy and content and they know that if they do, they will remain as their leaders.

Sadly, this is not the case with employee investors. Do business leaders ever ask their employees what return will satisfy them? Do they employ 'human' accountants to calculate and assess all the options that the employees will find attractive to stop them going elsewhere? Do they really care if they do?

The need to recognise employees as investors in the company is critical. So, too, is the need for business leaders to address the concerns and anxieties of employees. If they did, they will see that these concerns are not only related to the size of the pay packet. Other issues are respect and dignity; intellectual growth and development and recognition of value and worth to the company.

Companies need to take a new look at leadership. They need to view themselves in a holistic manner, comprising of assets, customers, shareholders and employees. They need the same style of leadership for all the components and followers of the 'whole' company. They need passionate leaders who can unequivocally confront all the anxieties of their followers.

The Association wishes to thank Bob Andrew who is a consulting value engineer and honourary member of the Association for his article. *He can be contacted on anneve@iafrica.com or boband@mweb.co.za*

Case History No. 18/2009

An evaluation of hot dip galvanized cable ladders after being exposed for some 25 years at a Cape Town Petro-Chemical Plant

The application

This petro-chemical plant in Cape Town was established in 1966 and these particular cable ladders which convey vital electrical and communication cables to various parts of the plant, were installed some 18 years afterwards in about 1984 (making them about 25 years old).

Having been originally contacted by Ian McArthur an electrical engineer at the plant who was interested in a duplex protected cable ladder at the time, as he felt this was necessary for long term sustainability in this plant. The discussion went about why a duplexed cable ladder was seen to be necessary and had 'galvanizing' on its own been thoroughly evaluated for past performance over a known life.

Ian then invited me to conduct this assessment and evaluation of some known aged hot dip galvanized cable ladders.

The cable ladders that were selected as the case history were identified as supplied by a company Adriano and Stefano (A&S) who were in existence when I was employed at my previous company, O-Line Support Systems, starting in 1987. The company A&S are no longer locally in existence.

Due to a higher side rail height of 140mm which is higher than the normal proprietary types of cable ladder and top-hat type cross rung configuration, these cable ladders were generally specified for use in most of the petro-chemical industrial plants at that time throughout South Africa.

continued on page 28...

The general view on the petro chemical plant in Milnerton.



Photo left shows the A&S Cable ladder in the foreground and a more modern edge mounted cable ladder in the background. Centre shows a close up of the A&S Cable ladder and right, residual coating thickness on the cross rung (89.5µm).

Photos above show coating thickness on the side rails (89.6 and 82.3µm) and again on the cross rung (82.3µm). Coating thicknesses are still well above that required by the standard.

The cable ladder had a 140mm high side rail and top-hat type cross rungs both made from 2.0mm mild steel. The splice was made as a flat plate bolted using 5 x M6 fasteners uniquely spaced on either side of the splice joint. The cable ladders and splices were hot dip galvanized by the general process which was then specified by the previous national standard, SABS 763. All fasteners on this cable ladder were either zinc electroplated or mechanically plated and were in an advanced state of corrosion. (In order to preserve the life of these fasteners and hence extend the life of the cable ladders, it is recommended that the fasteners be replaced or thoroughly cleaned and generously over coated with an appropriate zinc rich epoxy, such as 'Zincfix' or equal. One of the reasons why the cable ladder in the background (not an A&S type of cable ladder) was developed was so that M8 machine fasteners (used in this instance), which could be supplied as hot dip galvanized, would be used when the initial cable ladder was specified as hot dip galvanized.

Environmental conditions

The plant is situated in Milnerton within about three and a half kilometres off the Atlantic Coast line.

On closer examination of the cable ladder and while most corrosion products (mostly zinc chloride) were removed prior to recording coating thickness readings, the layer of

Only zinc electroplated fasteners have been supplied in some instances.

contaminants was not nearly as thick and as tenacious as experienced on other components used as example case histories in other similar regions along the coastline.

This suggests that the environment at hand even though it is categorized as marine is not nearly as corrosive as originally estimated. Using the indicators in ISO 9223 – Corrosion of Metals and Alloys – Corrosivity of Atmospheres – Classification and the slow rate of corrosion achieved suggests that this part of Milnerton is a C3 to at worst a moderate C4 environment taken from ISO 9223.

Hot dip galvanizing is specified primarily for corrosion protection. For this reason the two requirements to satisfy this requirement are coating thickness and continuity.

SANS 121 (ISO 1461) which superseded SABS 763 in 2000, requires that for steel thickness greater than and equal to 1.5mm and less than 3mm the local coating thickness be 45µm and the mean be 55µm. The coating thickness readings taken on both the side rail and cross rung of the cable ladder in question, still generously exceed this initial requirement.

Conclusion and recommendation

In requesting Association assistance in the evaluation of known aged hot dip galvanized components before over specifying the corrosion protection required by cable ladders for this plant, the electrical engineer, Ian McArthur has been rewarded with the knowledge that hot dip galvanizing on its own in most areas of the plant is the correct choice of corrosion protection.

Similarly in other sections of the plant where frequent maintenance painting is required on structural steel, hot dip galvanizing of this may have been the more appropriate and cost effective solution in the long run!

Photo left, shows the residual hot dip galvanized coating thickness on the boundary fence corner post.

NOW WITH CPD POINTS

Galvanizers Inspectors Course

Hot dip galvanizing is one of the most widely used methods of protecting steel from corrosion. As a final step in the process, the hot dip galvanized coating is inspected for compliance with the appropriate specifications.

This Galvanizers Inspectors Course has been designed to provide delegates with sufficient knowledge to test, inspect and interpret test results.

Following the course and successful result in a three-part exam, the delegate will be issued with a certificate, and if required, registered as an approved HDGASA inspector. Registration will be confirmed on an annual basis. Successful inspectors will become Individual members of the Association for the year.

The course is usually run from the Hot Dip Galvanizers Association in St Andrews, Bedfordview but from 2009 it will be available in Cape Town. Bookings are limited to 10 people on a first-come-first-serve basis.

COURSE CONTENT

- Introduction to corrosion
- Inspection before hot dip galvanizing
- Quality assurance in coating applications.
- Understanding zinc coatings
- Inspection after hot dip galvanizing

COURSE DURATION

This is a 2-Day Course comprising lectures on the first day, a Plant Tour in the morning of the second day, and the qualifying examination in the afternoon.

DATE AND TIME

Courses commence at 08h00 sharp and end at 16h30. Lunch and refreshments will be provided. Comprehensive course notes can be collected from our offices two weeks before the course.

Johannesburg:
October 6 - 7 and Nov 24 - 25.

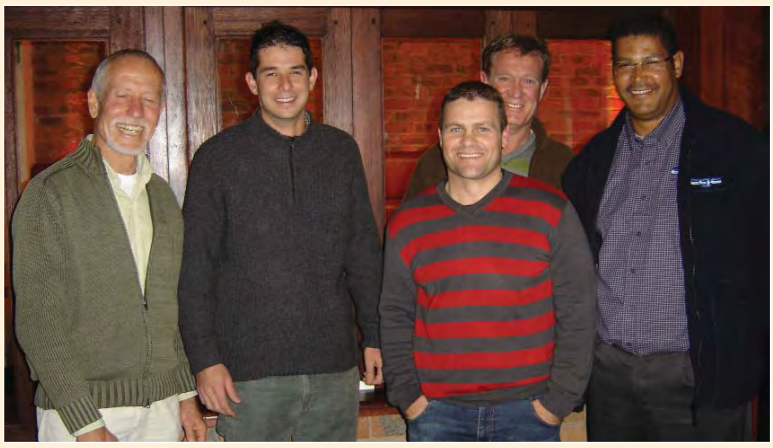
Cape Town:
September 9 - 10

COURSE COST AND PAYMENT TERMS

R2 800.00 per person inclusive of VAT. Should you have 2 or more delegates from the same company, course costs will be R2 600.00 per person inclusive of VAT. Please note that payment is due on the first day of training. Cheques to be made payable to "Hot Dip Galvanizers Association SA". Members qualify for a discount.

SHOULD YOU BE INTERESTED, KINDLY CONTACT SASKIA SALVATORI AT THE ASSOCIATION.

NOTE: All professional Engineers, Technologists, Technicians and Certificated Engineers are required to achieve a certain number of points for Continuous Professional Development (CPD). By attending the Association's two day Coating Inspection Course, you will obtain 2 points (accredited by ECSA).



Revised SANS 121 (ISO 1461:2009)

Although the local launch of ISO 1461:2009 has not yet been effected, its publication by the South African National Standards as in SANS 121 is imminent with the effective date being announced shortly. Here we address the differences between the 1999 and 2009 versions.

Revisions and updates to ISO 1461:1999 (2nd revision) to ISO 1461:2009 (3rd revision)

The third edition cancels and replaces the second edition (ISO 1461:1999), which has been technically revised.

Significant changes to the text include the following:

- Clause 1 Scope item a:

  Application of the standard to exclude woven or welded mesh products that are continuously galvanized.

- Clause 3 Terms and definitions:

  Additions of 3.16 and 3.17:

  - 3.16 Zinc melt – molten mass containing primarily zinc
  - 3.17 Weld seepage – emission of previously retained pretreatment solutions from narrow spaces between two closely contacting surfaces that have been subject to intermittent welding or from very small cavities (pinholes) in the welds of a galvanized article.

- Clause 4.1 General:

  The updated standard sets out requirements for the contents of the zinc melt used to apply a galvanized coating to articles (*refer clause* 4.2).

- Clause 6.1 Appearance:

  Additional explanatory notes on coating finish.

  "The primary purpose of the galvanized coating is to protect the underlying iron or

steelwork against corrosion. Considerations related to aesthetics or decorative features should be secondary. Where these secondary features are also of importance, it is highly recommended that the galvanizer and customer agree the standard of finish that is achievable on the total or in part, given the range of materials used to form the article. This is of particular importance where the required standard of finish is beyond that set out in this subclause. It should be noted that 'roughness' and 'smoothness' are relative terms and the roughness of coatings on articles galvanized after fabrication differs from mechanically wiped products, such as galvanized sheet, tube and wire. It is not possible to establish a definition of appearance and finish covering all requirements in practice.

The occurrence of darker or lighter area (e.g.

continued on page 32...

cellular pattern or dark grey areas) or some surface unevenness shall not be cause for rejection. The development of wet storage stain, primarily basic zinc hydroxide and some zinc oxide (formed during storage in humid conditions after hot dip galvanizing,) shall not be cause for rejection, providing the coating thickness remains above the specified minimum value.

Flux residues shall not be permitted. Lumps and zinc ash shall not be permitted where they may affect the intended use of the hot dip galvanized article or its corrosion resistance requirement [see ISO 14713 for corrosion protection performance data]. Articles that fail visual inspection shall be renovated in accordance with 6.3 or regalvanized and resubmitted for inspection.

NOTE *In certain circumstances, for example, where the galvanized article is to receive a further treatment or application of additional coatings, the purchaser might ask the galvanizer*

a) not to quench the article, and/or

b) to take measures to prevent the formation of corrosion products on the surface of the galvanized coating during storage and transport.

Flux residues shall not be permitted. Lumps and zinc ash shall not be permitted where they might affect the intended use of the hot dip

REQUIRED NUMBER OF REFERENCE AREAS FOR TESTING		
Category	**Size of significant surface area**	**Number of reference areas to be taken per article**
a	> $2m^2$	≥ 3
b	> $100cm^2$ to ≤ $2m^2$	≥ 1
c	> $10cm^2$ to ≤ $100cm^2$	1
d	≤ $10cm^2$	1 on each of *N* articles
NOTE $2m^2$ = 200cm x100cm; $100cm^2$ = 10cm x 10cm.		

Table 2.

ISO 1461:2009 (changes are highlighted in red)				
MINIMUM COATING THICKNESS AND MASS ON SAMPLES THAT ARE NOT CENTRIFUGED				
Article and its thickness	**Local coating thickness (minimum) µm**	**Local coating mass (minimum) g/m²**	**Mean coating thickness (minimum) µm**	**Mean coating mass (minimum) g/m²**
Steel > 6mm	70	505	85	610
Steel > 3mm to ≤ 6mm	55	395	70	505
Stee l ≥ 1.5mm to ≤ 3mm	45	325	55	395
Steel < 1.5mm	35	250	45	325
Castings ≥ 6mm	70	505	80	575
Castings < 6mm	60	430	70	505
The local coating thickness in Table 3 shall only be determined in relation to reference areas selected in accordance with 6.2.3. In cases of dispute, the results of gravimetric tests (coating mass) take precedence over the results of coating thickness tests.				
ISO 1461:1999 (Original revision 2)				
Article and its thickness	**Local coating thickness (minimum) µm**	**Mean coating thickness (minimum) µm**		
Steel ≥ 6 mm	70	85		
Steel ≥ 3mm to < 6mm	55	70		
Steel ≥ 1.5mm to < 3mm	45	55		
Steel < 1.5mm	35	45		
Castings ≥ 6mm	70	80		
Castings < 6mm	60	70		
ISO 1461:2009				
MINIMUM COATING THICKNESS AND MASS ON SAMPLES THAT ARE CENTRIFUGED				
Article and its thickness	**Local coating thickness (minimum) µm**	**Local coating mass (minimum) g/m²**	**Mean coating thickness (minimum) µm**	**Mean coating mass g/m²**
Articles with threads: > 6 mm diameter ≤ 6mm diameter	 40 20	 285 145	 50 25	 360 180
Other articles (including castings) ≥ 3mm < 3mm	 45 35	 325 250	 55 45	 395 325
ISO 1461:1999 (Original revision 2)				
Article and its thickness	**Local coating thickness (minimum) µm**	**Mean coating thickness (minimum) µm**		
Articles with threads: ≥ 20 mm diameter ≥ 6 mm to < 20mm diameter > 6mm diameter	 45 35 20	 55 45 25		
Other articles (including castings) ≥ 3mm < 3mm	 45 35	 55 45		

galvanized article or its corrosion resistance requirement (see ISO 14713-1 [7] *for corrosion protection performance data).*

Aesthetic effects (e.g. weld seepage) resulting from the use of intermittent welds around overlapping surfaces in the fabrication should not be a cause for rejection. Use of this type of welding pattern often results from consideration of health and safety issues. Further guidance is given in ISO 14713-2 [8].

Articles that fail visual inspection shall be renovated in accordance with 6.3. *Otherwise, the articles shall be regalvanized and resubmitted for inspection.*

When particular requirements exist (for example, when the galvanized coating is to be painted), a sample shall be produced [see A.2 *f)] at the purchaser's request."*

- Clause 6.2.2 Test methods:

  Simplified requirements for sampling and testing within Annex D.

- Clause 6.2.3 Reference:

  Introduction of a simplified table for the number of reference areas, being dependent upon the size of the individual articles in the control sample.

  An important phrase within this clause is:

  "Within each reference area of 10cm², a minimum of five magnetic test readings shall be taken on coated areas. If any of the individual readings is lower than the values in Tables 3 *or* 4, *this is irrelevant, as only the mean value over the whole of each reference area is required to be equal to or greater than the local thickness given in the table. The mean coating thickness for all reference areas shall be calculated in a similar way for the magnetic test as for the gravimetric test (see* ISO 1460). *Thickness measurements shall not be taken on cut surfaces or areas less than* 10*mm from edges, flame-cut surfaces or corners"*

- Clause 6.3 Renovation:

  The treatment shall include the removal of any scale, cleaning and any necessary pretreatment to ensure adhesion. The coating thickness on the renovated areas shall be a minimum of 100µm unless the purchaser advises the galvanizer otherwise, for example, when the galvanized surface is to be over-coated and the thickness for renovated areas is to be the same as for the hot dip galvanized coating. The coating on the renovated areas shall be capable of giving sacrificial protection to the steel to which it is applied.

  NOTE *See also Annex C for advice on repair of damaged areas.*

- Adhesion:

  Addition of references for the use of alternative renovation materials and for methods of adhesion testing.

- General:

  Information on the influence of the basis metal on the hot dip galvanized coatings produced and designed for galvanizing into the guidance document ISO 14713-2.

Steel Protection by Hot Dip Galvanizing and Duplex Coating Systems

(REVISED EDITION)

Steel Protection by Hot Dip Galvanizing and Duplex Coating Systems an extensive full colour, sixty page booklet on the subject has been revised and updated. As per the previous edition, a clear, simple and logical approach has been taken to guide the reader through an understanding of rust and its control, choice of rust prevention method is discussed, taking into account preparation, process and application as well as application conditions, coating properties, including dimensional stability and risk of transport damage.

The revised edition includes amongst other things, the revised SANS/ISO specifications for hot dip galvanizing. This includes the specifications applicable to general galvanizing as well as tubes by the semi-automatic process. In addition, more comprehensive information has been added to the sections covering continuously galvanized wire and sheet. The latter provides the latest available information on pre-coated sheet products available in South Africa.

The design and inspection of hot dip galvanized articles and their expected service life performance in a range of environments is critical to the successful application of hot dip galvanizing for corrosion control. Bolting and welding as well as comprehensive coating repair of hot dip galvanizing is also discussed.

This guide provides ample support for the specifier, designer and user to utilise the unique properties of hot dip galvanizing when applied to steel. As in other editions, information in this guide is based on scientific literature supported by the invaluable experience of various authorities, both local and overseas.

This edition is the 6th available in South Africa and the 4th written specifically for the local market. Based on earlier overseas editions, the contribution is acknowledged and greatly appreciated.

Measuring coatings on metal substrates (Part 5)

Gauges for measuring coating thickness

Calibration techniques

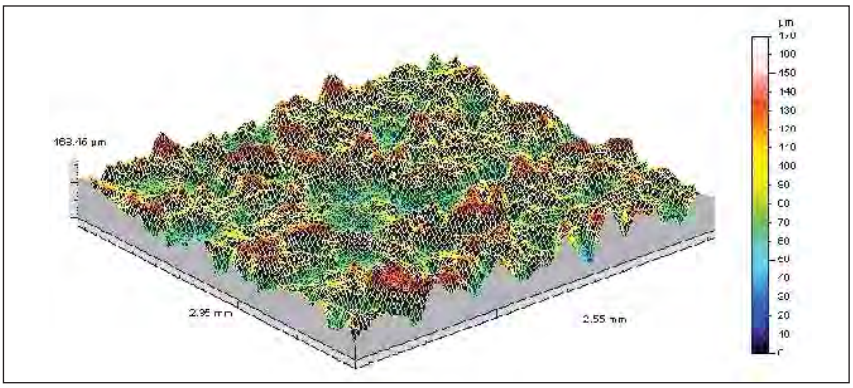
Previous parts of this series have shown that the readings on the gauge depend on what is being measured; the material, its curvature and roughness are the main variables. The process of adjusting the gauge to read thickness values correctly is called calibration and it is generally done with foils or shims of known thickness placed on an uncoated sample.

Most metal substrates with smooth surfaces give 'linear' readings, which means that if the coating thickness is doubled or halved, so is the reading on the gauge. A normal calibration is performed on these using one known thickness and a zero point on the bare surface.

Non-linear substrates include high-carbon steels and some stainless steels. For these, a 2-point calibration technique provides good readings over a shorter part of the scale. This calibration technique can be used for thick metal coatings on mild steel and for thin paints on thinly galvanised steel, such as is used for car bodies. It also helps on blast cleaned surfaces and sand castings to give readings that are effectively above the top of the peaks.

In this case, the uncoated surface does not read zero but a value below it (minus value).

The way to decide if a special calibration should be done is to conduct a test. Measure some known thicknesses of plastic or known coated samples and determine the deviation. The best method and the gauge to use will depend on the job requirements and what functions are available in a particular model.



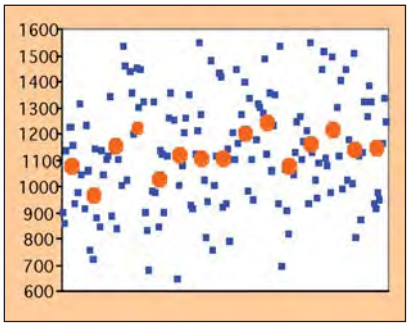
The map of a 'rough' grit-blasted surface, thanks to Corus. This 2.4 × 2.6mm area is similar to the 2mm diameter F1 probe tip, which will stand on many of these peaks.

Average

Roughened metal surfaces provide a range of readings depending on the shape of the surface profile, its amplitude and the density of its peaks. The way to reduce the spread is to calculate the average of the readings at a number of different spots (see graph).

Rough non-ferrous metal surfaces have a stronger effect on the reading than rough steel. However, when groups of readings are averaged, the results are reasonably consistent though some variation remains. In the graph, the average coating variation is about 95-125 but the individual readings ranged 600-1600. This technique is valid because it takes away the 'noise', due to the mechanics of the surface and placement of the probe, exposing the 'real' readings.

Elcometer 355 Standard.



The average of 10 (as orange dots) is less scattered than each reading (blue squares)

On the couch with

Anni Ramkisson

This edition I am privileged to interview a great friend and mentor, Anniroodh Ramkisson, known in the HDG fraternity as Anni, MD of Phoenix Galvanizing (Pty) Ltd and Phoenix Power Cables (Pty) Ltd. Anni and his brother Roy made history in September 1996 by becoming the first Hot Dip Galvanizers of colour in South Africa. On the eve of this, their 13th year in the Hot Dip Galvanizing Industry, Anni had the following to say about the journey.

How did you get into the hot dip galvanizing industry?

I was in the steel manufacturing industry for a number of years. The service levels of the existing local galvanizers were questionable, hence the motivation and an opportunity.

You, along with your brother, could be called the 'pioneers' of racial transformation in the hot dip galvanizing industry.

I think that we fit the profile, and all! (*tongue in cheek*).

You became the first hot dip galvanizer of colour on 9 September 1996 – looking back over more than a decade in the Industry, what would your comments be on the matter?

There were many opportunities post 1992, with the release of Mr. Nelson Mandela. Roy and I decided to take our chances to embrace on a new direction in a field previously not tread upon by non-whites. It has been an adventure. I would like to think that the services we introduced have raised the bar in terms of service delivery for the Industry as a whole. On an integration note, it is pleasing to see that other individuals of colour have also entered the hot dip galvanizing fraternity since the Ramkissons.

You are clearly a disciple for the coating – your recently completed Power Cables Building is fully hot dip galvanized, what does the coating mean to you?

Certainly the most effective system for corrosion protection with great aesthetics and cost effective.

What is the project that you are most proudly associated with insofar as hot dip galvanizing?

There have been too many projects over the years, projects that we feel very proud of being associated with. If I had to pick one, then I would say that Ushaka Marine World, which was the overall winner in the 2004 HDGASA Awards.

Speaking of which, Phoenix Galvanizing's name generally features very prominently, come HDGASA Awards. What is the secret to your success on this front?

I am fortunate that this area has enjoyed quite a bit of focus in my company in the sense of research and presentation. We have also been blessed with interesting and diverse projects – which of course is what the whole thing is about. Promoting the Industry!

Phoenix Galvanizing diversified into power cables a few years ago. Tell us about that?

Again, an opportunity presented itself with us becoming the first non-whites entering the field of electric cable manufacture. Electricity suppliers have started the roll-outs of massive infrastructure developments and our cables will be needed as part of this growth and expansion.

Many people are confused by the name Anni, please tell us about this unusual name's (for a guy) origin?

I am a 5th generation Indian; my great grandparents came to cut grass and cane. Now we Indians smoke the grass and drink the cane and become spirited!!! Many years ago I was a telephone cable jointer with Telkom. The English and Scottish people that worked with me could not pronounce Anniroodh and hence Anni for short.

When Anni Ramkisson goes home...

Anni Ramkisson is a workaholic. He is at the factory 7 days week if in the country. It's not a job; it's a passion and a way of life. I am however reading two books at the moment. (Barrack Obama and From Good to Great) I have the greatest passion for Formula 1 motor racing; have been to 14 races on the calendar around the world. I am also a lover of sports on the box. My partner is Latha and I am the proud father of sons, Amish and Ashish. Naturally all are fully entrenched in the cables business.

For more information see www.phoenixgalvanizing.co.za

The Association wishes to thank Desere Strydom for this contribution.

MISCONCEPTIONS

Miss Conception puts it "straight"

"Miss Conception" rectifies incorrect impressions concerning hot dip galvanizing.

If you require a thicker hot dip galvanized coating you should specify it as C4 or C5 (in terms of ISO 9223) hot dip galvanizing!

True or false?

When pre-cleaned steel is dipped into molten zinc at about 450°C a chemical reaction takes place whereby a coating structure comprising a series of iron/zinc alloys, overcoated with a relatively pure zinc layer is metallurgically bonded to the steel substrate. Coating thickness and appearance are therefore mainly influenced by the laws of metallurgy, where the chemical composition of the steel, steel thickness and surface roughness, play the major roles.

Composition and the Metallurgy of the Steel

Some carbon steels are more reactive to molten zinc and in spite of the modern steel making continuous casting process, this phenomenon still occurs. With the continuous casting process, either silicon or aluminium is added to the steel as a de-oxidising agent. These steels are respectively known as aluminium-killed and silicon-killed steels. Aluminium-killed steel generally includes all flat steel up to 4.5mm thick, which can end up being used to manufacture tubes, etc. Silicon-killed steel generally includes all hot rolled profiled steel and flat plate greater than 4.5mm thick. While aluminium additions to steel have no effect on the coating structure and thickness of a galvanized coating, the same cannot be said for silicon, where certain amounts of silicon can have a major effect on increased alloy growth during hot dip galvanizing. Phosphorus in graded steel is usually less than 0.001%, which at this level rarely has an effect on alloy growth either with silicon or on its own. However in steel where phosphorus exceeds 0,02% (generally some of the commercial grade steels) reactivity to molten zinc will increase.

Thickness of the Steel

The thickness of the steel influences the coating thickness. Generally, the thinner the steel the thinner the coating. This applies especially to aluminium-killed steels. One reason for this is that articles fabricated from thinner steels, generally require shorter immersion times. Although relatively infrequent, it is for this reason that when reactive thinner steels are welded to non-reactive thicker steels, inordinately thicker coatings may result on the thinner steel. There is a far greater possibility that non-reactive thinner steel is welded to reactive thicker steel and the resultant thicker coating on the thicker steel may be aesthetically less acceptable and prone to brittleness and therefore potential damage, particularly on edges. Mechanical manipulating, including rolling, bending and heat treatment, plus any welding of the steel, can lead to different reactions in the zinc bath.

Surface Condition

Varying surface roughness of the steel leads to variations in thickness of the coating. The rougher the surface of the steel, the thicker the coating. Depending on the type of steel and the surface profile, preparation treatment such as abrasive blasting can result in a 10 to 15% thicker coating. Steel that has been severely attacked by rust, or over pickled, also results in increased coating thickness.

Although the galvanizer to a degree can influence the resultant coating thickness, his influence is mostly limited. For instance he can:

- Extend the immersion time

1. For most silicon-killed steels a longer immersion time will produce a thicker coating.
2. However, with some semi-reactive silicon-killed steels the immersion time required to produce the initial coating thickness, may have to be doubled in order to achieve a marginal increase in coating growth. This would obviously impact on the productivity and hence profitability of the galvanizer.
3. If the steel is aluminium-killed (very little silicon and no phosphorus – low reactivity) longer immersion times will not necessarily produce a thicker coating. *See figure* 25.

- Speed up the withdrawal rate. (Slow withdrawals result in thinner coatings, faster withdrawals thicker coatings). Most galvanizers have a crawl speed installed on their crane control so that it is easy for the crane operator to adhere to the norm of slow withdrawal, so increasing the withdrawal rate may not be practical.
- Depending on the facility, the components length and the crane hook height, the preferred angle of exit is about 35 to 45° angled to the horizontal, some galvanizers may find this impractical or not achievable due to plant restraints.

Although SANS 121 (ISO 1461) has no reference to a heavy duty coating, by popular request from the South African specifier a heavy duty coating was required mostly for mining or coastal conditions. This has been included in the South African Bureau of Standards - General and Specific Permit Conditions issued to all Mark Scheme Holders, whereby a heavy duty coating of at least 25% greater than that given in ISO 1461, (not centrifuged) can be achieved without compromising specification conformity.

Although a heavy duty coating can be requested particularly with thick steels, a thick coating of in excess of 25% in most instances is common! Should this requirement be critical, samples should be galvanized to achieve the required coating thicknesses, the results monitored subsequent to discussions and then suitable instructions implemented.

Therefore, should a specifier require a coating thickness in excess of that set out in SANS 121(ISO 1461), a heavy duty coating may be specified. This is done in accordance with the "General and Specific Permit Conditions", by the South African Bureau of Standards issued to all Mark Scheme Holders. In addition for practical purposes, the requirement should also be discussed with the galvanizer prior to finalizing the order. For a number of technical and practical reasons and steel types, a heavy duty coating may not always be achieved.

In addition the specifying of a C4 or C5 hot dip galvanized coating is incorrect because it relates to ISO 9223 – Corrosion of metals and alloys – Corrosivity of atmospheres – Classification, which by its title is a classification of atmospheres and although a thicker hot dip galvanized coating (or duplex coating) is necessary for long term durability in these atmospheres it is not the manner in which to specify such a coating!

Note: All steel can be hot dip galvanized but should the specifier require a particular result, eg. architectural quality, the correct steel grade must be specified, see table 16.

Due to space constraints figure 25 *and table* 16 *have not been included in this article, kindly refer to the Association's "Steel Protection by Hot Dip Galvanizing and Duplex Coating Systems".*

HOT DIP GALVANIZING MEMBERS

GALVANIZER	LOCATION	TEL. NO	SPIN	NO. OF LINES	BATH SIZES (L x W x D) (m)
GAUTENG					
Armco Galvanizers	Isando	011 974-8511		1	13.2m x 1.5m x 2.2m
Armco Galvanizers – Dunswart	Dunswart	011 914-3512	●	3	5.2m x 1.2m x 2.0m 3.0m x 1.0m x 1.5m 2.0m x 1.0m x 1.5m
Babcock Nthuthuko Powerlines (Pty) Ltd	Nigel	011 739-8200		1	12.0m x 1.4m x 1.8m
Cape Gate (Pty) Ltd	Vanderbijlpark	016 980-2270		#	Wire galvanizer
DB Thermal SA (Pty) Ltd	Nigel	011 814-6460		In-line	16.0m x 1.0m x 1.0m
Galvadip (Pty) Ltd	Waltloo	012 803-5168		1	7.2m x 1.5m x 1.8m
Galvrite Galvanising (Pty) Ltd	Randfontein	011 693-5825		1	6.5m x 1.3m x 2.0m
Galvspin Galvanizers cc	Boksburg North	011 894-1426	●	2	2.0m x 1.2m x 1.5m 1.5m x 1.0 x 1.5m
GEA Air Cooled Systems	Germiston	011 861-1571		In-line	11.5m x 1.0m x 1.0m
Lianru Galvanisers cc	Nigel	011 814-8658		2	7.2m x 1.3m x 1.6m 4.5m x 1.3m x 1.6m
Macsteel Tube & Pipe	Boksburg	011 897-2194		In-line	13.5m x 1.6m x 2.4m
Mittal Steel SA	Vereeniging	016 889-8816		#	Sheet galvanizer
Pro-Tech Galvanizers (Pty) Ltd	Nigel	011-814-4292	●	2	3.2m x 1.1m x 1.5m 3.0m x 1.1m x 1.2m
Robor Galvanizers (Pty) Ltd	Germiston	011 876-2900		3 Tube	14.0m x 1.35m x 2.5m 10.0m x 2.0m x 4.0m Dia 42mm to 114mm max tube length 6.7m
Robor Tube	Elandsfontein	011 971-1600		1	Tube & pipe galvanizer
Supergalv	Alrode	011-908-3411		1	6.0m x 1.2m x 1.8m
NORTH WEST					
Andrag Agrico	Lichtenburg	018 632-7260		#	In-line galvanizer
FREE STATE					
Harrismith Galvanizing & Steel Profile	Harrismith	058 623-2765		1	12.0m x 1.2m x 2.5m
WESTERN CAPE					
Advanced Galvanising Corp.	Bellville	021 951-6242		1	8.0m x 1.5m x 3.0m
Cape Galvanising (Pty) Ltd	Parowvalley	021 931-7224		1	14.0m x 1.6m x 2.6m
Galvatech (Pty) Ltd	Bellville	021 951-1211		1	7.5m x 1.5m x 2.6m
Helderberg Galvanizing	Strand	021 845-4500		1	5.5m x 0.8m x 2.4m
Pro-Galv cc	Stikland	021 945-1803		1	7.2m x 1.3m x 2.6m
South Cape Galvanizing (Pty) Ltd	George Industria	044 884-0882		1	3.7m x 0.94m x 2.3m
EASTERN CAPE					
Galvanising Techniques cc	Port Elizabeth	041 486-1432		1	12.0m x 1.3m x 2.3m
Galvaspin (Pty) Ltd	Port Elizabeth	041 451-1947	●	1	3.0m x 1.2m x 1.8m
Morhot (Pty) Ltd	East London	043 763-1143		1	6.0m x 1.2m x 2.5m
KWAZULU/NATAL					
A&A Galvanisers	Pietermaritzburg	033 387-5783	●	1	3.3m x 0.9m x 1.9m
Bay Galvanisers	Richards Bay	035 751-1942		1	5.0m x 1.2m x 2.5m
Phoenix Galvanizing (Pty) Ltd	Phoenix	031 500-1607	●	2	14.0m x 1.4m x 2.5m 3.0m x 1.2m x 1.2m
Pinetown Galvanizing	Pinetown	031 700-5599		1	9.0m x 1.2m x 3.0m
Voigt & Willecke (Pty) Ltd	Durban	031 902-2248		1	14.0m x 1.3m x 2.5m

 # Sheet, wire, pipe and other in-line galvanizing members dedicate their plants to the galvanizing of their own products.

Note:

- *Where more than one galvanizing line is available, the number of lines and the significant bath dimensions are listed, ie. widest, longest and deepest.*
- *For specific contact names (e.g. sales or production personnel) and mobile telephone numbers, contact company receptionist.*
- *The bath sizes are inside dimensions and not maximum component size (length, width and depth). Kindly take note of the expansion of the component when dipped into molten zinc, or discuss with relevant galvanizer.*