HOT DIP

2005 Volume 2 Issue 3

GALVANIZING TODAY

HOT DIP GALVANIZERS ASSOCIATION Southern Africa

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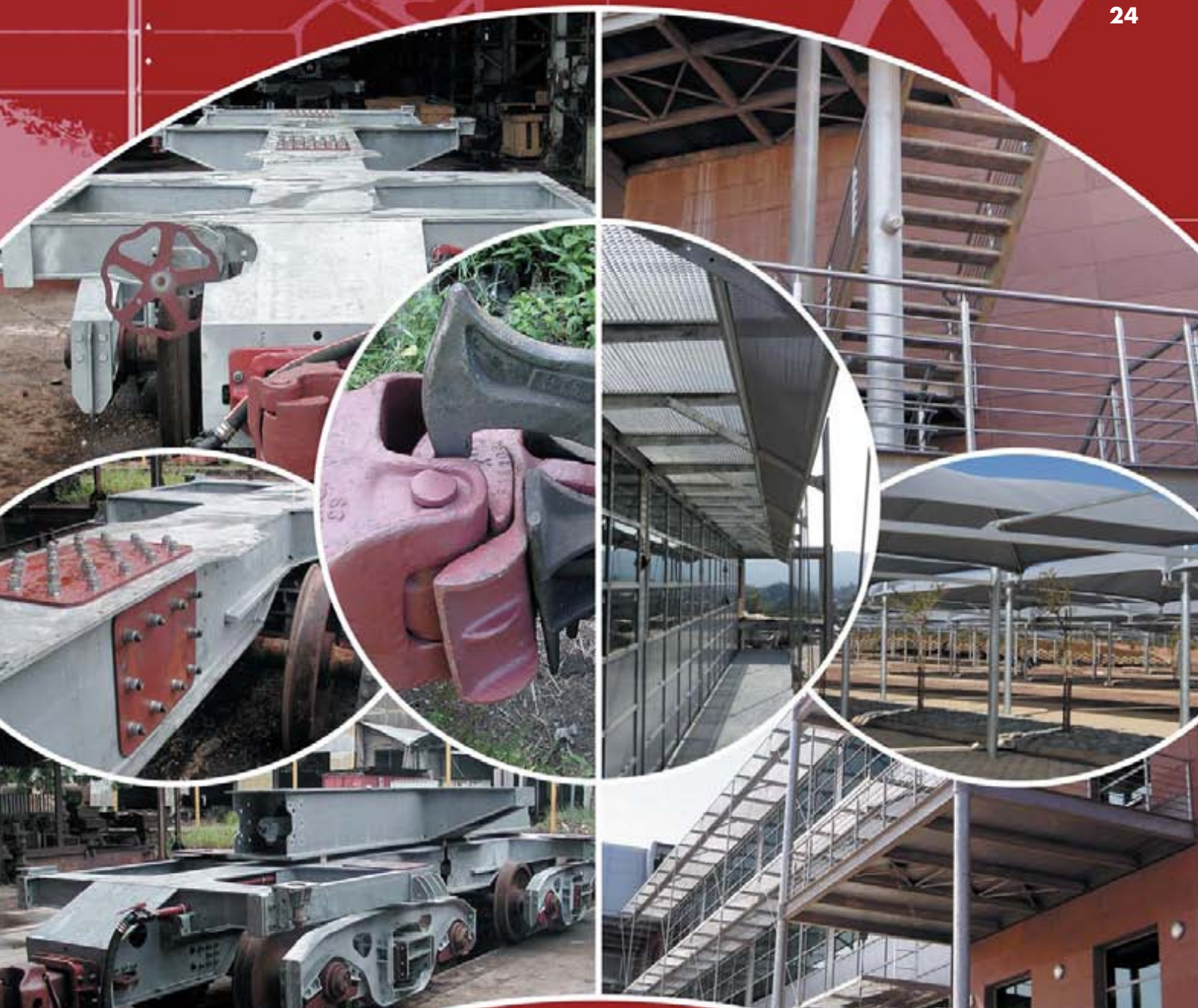

Featuring:

The 2005 Eskom Hot Dip Galvanizing Awards – winners and entries

The Hot Dip Galvanizers Association's anniversary – adding value to steel for 40 years

History of hot dip galvanizing

The significance of appropriate specification or selection of a steel palisade fence

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Part of the Barloworld Robor Group

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

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HOT DIP GALVANIZING TODAY

Official journal of the Hot Dip Galvanizers Association Southern Africa • 2005 Volume 2 Issue 3

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ISSN 1023/781X

CONTENTS

Front Cover: *A kaleidoscope of photographs reflecting the joint winners of the Eskom Hot Dip Galvanizing Awards.*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment

It is hard to believe that almost another year has past since our 2004 awards. This particular issue, of our journal, will feature the 2005 hot dip galvanizing awards. To all the organizations and individuals who compiled and submitted hot dip galvanized and, duplex coated projects, for consideration by our panel of "independent judges", a sincere word of thanks. Without these submissions our awards evening could not take place. The focus of the awards is to recognize individuals and organizations 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.

They say time flies when you are having fun, but in the case of the Association, time has flown due to our past year's activities.

These activities include numerous technical sales presentations to end users, consulting engineers, fabricators and the like. As an Association of the hot dip galvanizing industry we have continued to develop case histories and information sheets, designed to answer frequently asked technical or quality questions. Implementation of the skills development programme continues, all be it at a very slow pace. An environmental project aimed at the establishment of control parameters for our industry is being completed and will be submitted to the relevant authorities for their approval and implementation.

However, one particular outstanding achievement has been the re-introduction of "Hot Dip Galvanizing Today". One year ago we saw the re-launch of our journal as a fully fledged magazine, which is aimed at improving our contacts with the wider industry and to ensure the dissemination of the numerous technical issues relating to the application of hot dip galvanizing and duplex coatings, for the corrosion protection of carbon steel.

Numerous positive and complimentary comments, relating to this publication, have been received from a number of individuals and organizations. Such feedback is, without doubt, motivational for the individuals that have spent many hours to make this magazine interesting and informative, to as wide an audience as possible. It is hoped that the various issues covered in our magazine will be retained and used within a client's library system, as a worthwhile reference source relating to application of hot dip galvanizing and duplex coating systems.

On a personal basis, I congratulate and express my gratitude to the individuals involved with the production of the magazine. Continued support, in the form of editorials, comments, enquiries and advertisements, from the readership, will ensure that the magazine will develop and reach as wide an audience as possible.

Bob Wilmot

Note from the Editor

My, how time has flown this year, it's already August and time for the annual Eskom Hot Dip Galvanizing Awards Evening. For the first time this year a number of judging criteria were introduced. This was done to ensure that the entrant emphasise all the salient points required by the judging panel and therefore increase his chances of success. The judging criteria were also deemed by the Association to be a more fair system. A number of the entries, including the two winners, used these judging criteria to their advantage and thereby ensured success. In this issue we highlight all the entries, the category winners and the two projects that took overall honours.

Congratulations to all the winners!

We further celebrate the Association's 40th anniversary and highlight some of the events through the years that the Association was proud to have been part of. We look forward to the next 40 and know that they will be even more eventful.

It's a fact of life in our exciting developing nation that those of us who have worked hard for our homes and possessions, also need to take some action to protect them. This can take the form of perimeter protection such as a fence, possibly electrified, burglar alarms and/or armed response but generally a combination of these will provide reasonable protection.

Perimeter protection in the form of a steel palisade fence and how one goes about specifying or selecting it is the feature for this edition.

The average non-technical homeowner looking for a steel palisade fence might start with his monthly home magazine, of which there are many or alternatively his choice might be based on referrals from friends or work colleagues.

The selected company's will then visit the prospective client and I would imagine will discuss the following:

Height and length of fence, shape of paling top, gap between palings, colour, gate/s position and shape, electrified or not and finally price.

What might not be discussed is the choice between welding or bolting, and with the latter, does it include anti-vandal shear nuts or some method of limiting the removal of the fence when erected; how is it protected from corrosion and how stiff will the fence be (flexural strength), how the fence posts are fixed in the ground (soil or concrete foundations), etc.?

Through the article "Much more than a fence", we highlight the requirements of SANS 301 part 12: Specification for steel palisade fences. This specification is based on BS 1722 and we hope that the information assists those that are endeavouring to install a palisade fence.

Besides our regular articles of Guest Writer, Misconceptions, Personality Profile and Walter's Corner, we have introduced a checklist for use when architectural hot dip galvanizing is required. The list highlights both the specifier / designer and the galvanizer's requirements, with written communication between all parties being very necessary for success.

Finally, we have included a portion of the many letters received over the years from clients who felt it was necessary to record their thanks and appreciation for matters resolved by the Association.

We once again welcome reader's comments on any aspect of the Association's activities or this magazine.

Terry Smith

It's a plan that will save South Africa over R5 billion between now and 2010, an Eskom initiative that will also save you money on your monthly electricity account in addition to going a long way to saving our environment. To keep up with a 15% annual peak demand, we have to recommission old and build new power stations plus encourage everyone to have a more intelligent approach to the use of electricity. So, over the next few months we are going to be giving you lots of advice on how you can conserve electricity at home and at work without experiencing the slightest inconvenience. And when one considers that the intelligent use of electricity will save money for all of us, as well as save our beautiful environment, what better motivation do we need?

Eskom

With Energy, Anything is Possible

2005 Eskom Hot Dip Galvanizing Awards

Overall Joint Winner and Architectural Category Winner

MTN Headquarters Building – Phase I and II

Description

MTN requested the use of a hot dip galvanized coating in an architectural manner in order to protect all the external steelwork of their head-quarters, achieve a dull matt grey steelwork finish and more importantly to minimise future maintenance.

Location

Fairlands, Johannesburg

Tonnes of steel

Approximately 600 tonnes

Type of steel

Hot dip galvanized building facades, floor gratings, sunscreens, staircases, perimeter fence and shade cloth supports.

Project partners

Owner:
MTN

Property developer:
RMB Properties

Developer:
Fikile Stocks

Architect:
Boogertmann & Partners

Specifier:
Africon Johannesburg & Pretoria

Contractors:
Tass Engineering, Magnet Engineering, Nancy Engineering and Omni Struct

Hot dip galvanizers:
Armco Galvanizers, Barloworld Galvanizers and Supergalv

Project inception date

2004 to 2005

Project value

R270 million

Information

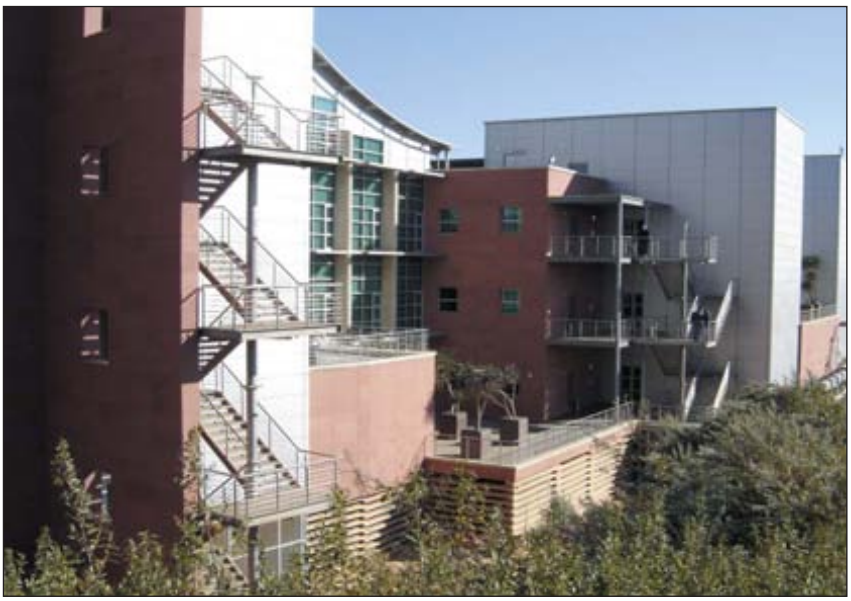
- The quality of the hot dip galvanized coating had to be above the standard required by the SANS 121 (SABS ISO 1461) hot dip galvanizing specification. It was for this reason that an architectural checklist for the designers and the respective galvanizers was compiled and issued to the respective contractors.
- When Phase I of the MTN head office was built, the architect required that a handrail configuration be hot dip galvanized for erection at the site mock-up. This mock-up was to provide the client with a look and feel of the components before the final decision of material or coating choice was made for the project.

The sample was hot dip galvanized without any prior instruction from the contractor to

the galvanizer as to the function of the article.

On seeing the erected sample, which was of poor aesthetic appeal, the architect contacted the HDGASA for assistance. This led to an alternative material being specified for the hand railing for Phase I, with the HDGASA requesting involvement in the planning of Phase II. The involvement in Phase II of the HDGASA led to the compilation of the "Architectural Checklist" and a restrictive repair procedure being drawn up for implementation at the start of the project.

- Although the use of hot dip galvanizing for architectural purposes is small by comparison to the mainstream use of the coating in Gauteng, the introduction of the checklist promotes effective communication between all parties, thereby increasing the use of hot dip galvanizing in architectural applications.
- Due to the long term maintenance-free aspects of hot dip galvanizing, the client will not have to maintain the hot dip galvanized components for the foreseeable future.
- Training by way of frequent site meetings to most members of the project team, followed up by staff meetings at the respective companies, ensured that all possible measures were



implemented to reduce errors both in the short term as well as medium and long term for other projects.

- The Phase I and II of the MTN headquarters have made extensive use of hot dip galvanizing, namely for building facades, floor gratings, sunscreens, numerous staircases, perimeter fence and shade cloth support structures.
- Various hot dip galvanizers were used due to the size of the project as well as size of items that had to be hot dip galvanized.
- MTN has in the past been a supporter of the hot dip galvanizing industry by way of its masts throughout South Africa and north of the border.
- A further alliance has been forged with various project team members, including the Architect, Structural Consultant, the Main Contractor and all the Sub-Contractors.
- It is anticipated that the check list system will be further understood and enhanced on subsequent phases of the project.

Overall Joint Winner and Innovation / Research & Development Category Winner

KFP Tread Steer Bogie

Description

A fully steel-fabricated, hot dip galvanized modular and compact "meccano kit" type railway rolling stock suitable for the transportation of 20 foot and/or 40 foot containers.

Location

In use by East Africa Hauliers (Ltd)

Project partners

Developer / Owner:
Kwik Fab Projects

Project manager:
Craig Penn-Clarke

Hot dip galvanizer:
Barloworld Galvanizers

Project inception date

Late 2004 to early 2005

Some of the modular components, jigged and ready for hot dip galvanizing.

A view on a single hot dip galvanized bogie.

A view on two hot dip galvanized bogies ready for service.

The locomotive pulling some of the completed hot dip galvanized bogies into place.

Information

- KFP Rail (Pty) Ltd approached the HDGASA with a detailed scale model of an innovative design for the construction of railway rolling stock.
- From its inception, KFP had planned to use hot dip galvanizing as well as duplex coatings for the corrosion protection system for the rolling stock. Certainly within Southern Africa, the use of hot dip galvanizing and/or duplex coatings for corrosion protection of rolling stock is unique and believed to be a first.
- By using the scale model, KFP and the HDGASA were able to review the supply chain with a view to ensuring consistent quality and service for the current and future contracts.
- The overall size of the product would normally prevent hot dip galvanizing, but due to the innovative design and modular sections, all components were hot dip galvanized by a single, complete immersion, which guaranteed corrosion protection of external as well as internal surfaces.
- The project has introduced a new

A view on several hot dip galvanized bogies, ready for service.

concept into the construction of container-carrying railway trucks, which can be shipped in containers and assembled at remote locations with the minimum of skilled labour and site supervision. This aspect of the design was of primary importance as markets around the world, and Africa in particular, require a holistic and innovative approach to their transportation needs; both for the railways as well as future road transport trailers.

- All the components comprising the railway truck are hot dip galvanized, but the inclusion of a duplex system is also planned, thereby increasing corrosion protection and to facilitate specific railways livery.
- Corrosion protection by way of hot dip galvanizing will increase the service life of the product anywhere between 3 to 4 times that of the painted counterpart.
- Once the hot dip galvanized coating has reached the point of 5% rust, the product can be re-galvanized and returned to service.
- Environmental control is exercised within the galvanizing plant as opposed to the application of protective coatings at a remote site location.

A detailed scale model was built for initial discussion with all parties.

Vintage Category Winner

Armco Multiplate and Superspan Structures – Kruger National Park

Description

Corrugated steel culverts, all of which were hot dip galvanized, have been used extensively throughout the Kruger National Park on their road building programme. The original road construction programme commenced during the 1960's and was continued through until the mid 1980's, by which time much of the road construction within the park had been completed.

Location

Kruger National Park

Tonnes of Steel

Approximately 800 tonnes

Project partners

Developer / Owner:
Kruger National Park

Project manager / Specifier:
Kruger National Park Roads Engineers

Hot dip galvanizer:
Armco Galvanizers

Project inception date

Early 1960's through to mid 1980's

Information

- The state of the inspected structures, including the corrosion protection system used (hot dip galvanizing), are of such a standard that feedback from the Park's Road Engineer is that they will continue to use the product in the future.
- In order to extend the service life of some of the structures, a duplex coating was employed by the application of a bitumen coating between the hot dip galvanized surface and the soil side of the structure.
- The newest installation inspected (installed in 1974) was the corrugated steel product referred to as a superspan structure. This is an innovative design originating from Armco Canada during the early 1970's.
- The triple superspan structures, just north of the Letaba camp, represent the first such installation not only in South Africa, but also in Africa.
- The structures easily blend into the natural bush surroundings.
- The project is an excellent case history. Due to its performance other structures, such as steel water tanks, fencing and communication towers are being hot dip galvanized.
- At the time of construction, alternative concrete structures proved to be more expensive.
- The Superspans employ unique reinforced concrete thrust beams located at the two and ten o' clock positions of the end or mouths of the structure. The design of these beams is used to dissipate loads from the steel structure into the compacted soil at each end of the installation.
- The use of corrugated metal culverts is not only limited to drainage structures in National Parks. Many structures are still in use in South Africa and Export Territories viz: Lesotho, Swaziland, Botswana, Zimbabwe, Zambia, Mozambique, Tanzania, Kenya, Uganda, Angola, Ethiopia, Australia and Iran.
- Other applications include mine ventilation shafts, magazines that house explosives, bomb-shelters, water tanks, charcoal kilns, stockpile tunnels, rock shutters and CBD pedestrian underground access tunnels.
- Longevity is highlighted and confirmed by the fact that the structures have proven performance of between 25 - 40 years.
- Once these structures have reached their anticipated service life, they can be rehabilitated in a variety of ways to further extend their service life (see article on page 43).

The structures easily blend into the natural bush surroundings.

Mining and Industrial Category Winner

DDL Equipment – Dock Levellers

Description

The hot dip galvanizing of Dock Levellers in order to prevent the problem of corrosion and the cost of repairing the coating.

Tonnes of steel

1 tonne per leveller

Project partners

Developer / Owner and specifier:
DDL Equipment

Project manager:
Andrew Stewart

Hot dip galvanizer:
Barloworld Galvanizers

The design and jigging techniques were significantly improved, resulting in successful hot dip galvanizing.

Information

- Dock Levellers are used mainly in the meat and abattoir sectors where there is a lot of liquid being used (such as water and soap to remove blood from various items). Vehicles ride up and down these levellers and when the paint surface is damaged, corrosion takes place. These levellers were traditionally painted, with the first attempt to hot dip galvanize resulting in severe distortion.
- Both Barloworld Galvanizers and the HDGASA met with Andrew Stewart in an attempt to refine both the design of the levellers and some technical aspects of the hot dip galvanizing process.
- The original design of the levellers was enhanced and certain procedures were put in place for the handling and hot dip galvanizing of these components (such as the way in which these items were supported at the jigging stage), and the product was hot dip galvanized, with no distortion.
- The component comprises steel of varying thicknesses in the form of "vastrap" plate, hot rolled angle and channel sections.
- Due to the lack of future coating maintenance, the market for hot dip galvanized dock levellers will broaden, especially in the coastal areas as well as for the export market.
- The end user will benefit from the savings in terms of regular paint coating maintenance as well as the down time required when maintenance is carried out. The benefits of the choice of coating will ensure that the hot dip galvanized dock leveller's provide significantly increased value to the end users of these products.

Export Category Winner

CBC Fasteners – manufacture of class 5.6 hexagon head bolts, hot dip galvanized and exported

Description

Manufacture of steel hexagon head bolts for structural steel bolting class 5.6 as per DIN standard 1990, hot dip galvanized for corrosion protection.

Tonnes of Steel

70 tonnes (pilot project)

Type Of Steel

Bolt and Nut Rounds Coiled

Project Partners

Customer:
Fator-Barcelona, Spain

Manufacturer:
CBC Fasteners (Pty) Ltd

Hot Dip Galvanizer:
Armco Galvanizers

Project Inception Date

January 2005

Project Value

R665 000.00

Information

- Fator had a special requirement for construction power line bolts (class 5.6). Fator specified hot dip galvanizing, with no alternative methods of corrosion protection being considered.
- The product had to comply with the DIN 7990 standard and all vital aspects of mechanical properties were checked and monitored throughout all stages of the manufacturing process.
- One of the most important requirements was related to the resilience and toughness under extreme minus zero temperatures.
- The product was hot dip galvanized to SANS 121 (SABS ISO 1461) standard requirements and mechanical properties as per ISO 898-1.
- The raw material before manufacturing, but after heat treatment, was sent in the form of rods to the customer for testing and approval.
- 10 samples were collected for customer testing from each batch of product with a length over 40mm.
- The product was sprayed with wax after hot dip galvanizing in order to protect them from wet storage stain during sea transport and specially packed in wooden boxes, with a mass of 800kg.
- It was vital that this project be executed professionally as it was a trial order, which would lead to CBC becoming accredited in Spain, hence increasing future market potential.
- There has never been a demand for class 5.6 fasteners in the local market because of limited knowledge in the Construction Power Line Industry and also due to climatic conditions, which are different from far North or South. Within Europe, temperatures can range between -40°C in some areas and +40°C in other areas. It is vital that the fastener does not change its mechanical properties or lose any ability to keep the construction safely together under these harsh weather conditions.
- CBC Fasteners' major steel supplier is MITTAL Steel, who supplied them with SAE 1018 steel from which the product has been manufactured.
- Due to competitive pricing, washers and nuts were supplied from the East to South Africa, by the customer. Containers were off-loaded, unpacked and checked and thereafter assembled by CBC Fasteners Durban Distribution Centre.

- Many different stages of manufacturing and testing involved different companies and required full information transfer. Close cooperation and coordination was required.
- CBC Fasteners specified that the galvanizer treat this product as class 10.9 High Tensile steel. The galvanizer had developed a specific procedure for the hot dip galvanizing process. This procedure included a comprehensive Quality Control Plan, which needed to be completed for each batch to ensure the required standard.
- The average coating thickness achieved was 71 microns.
- As a result of the confidence established with the customer, CBC Fasteners has been appointed as the preferred supplier of fasteners in a construction project in Kazakhstan in former Soviet Union. This project is in excess of 500 tonnes.

Proudly Holding Industry Together ...

The buildings below are but a few of the many structures in South Africa and around the world which have used our fasteners. Whether it be a project on a grand scale, like the Barclays Building in London, or one with the mechanical demands of the London Eye, CBC can be relied upon to provide fasteners of the highest quality.

CBC manufactures over one million units a day, ranging from standard mild steel fasteners to sophisticated grade 10.9 and 12.9 bolts. We also produce specialised fasteners like the Hydraloc 'T' lockbolt system. CBC can boast an increasing role in supporting the steel construction industry with technical information and backup.

CBC has invested substantially in training and development, as well as worker-safety programmes. We are committed to maintaining the highest of standards thereby flying the flag of the South African steel industry both at home and abroad.

... and proud to be associated with the Hot Dip Galvanizers Association

CBC

FASTENERS

www.cbc.co.za

6 Coppinger Street, Factoria, Mogale City. Tel: 011 955 4485 H/O Fax: 011 664 6218

*Please e-mail **tech@cbc.co.za** if you have a technical query or if you would like an electronic copy of our technical data manual.*

PROUDLY SOUTH AFRICAN

ISO 9001 SABS

Buildings (from left to right) : Nelson Mandela Bridge, Johannesburg • Cape Town Convention Centre • The London Eye • Barclays Building, Canary Wharf, London

PYC GRAPHICS

Hot Dip Galvanized Steel Transmission Towers

Vintage Category

Description
The painting of hot dip galvanized steel transmission towers in the field in order to refurbish the overhead transmission lines.

Location
Greater Durban Metropolitan Area

Type of steel
Mild and High Tensile Steel to BS 4360

Tonnes of steel
5 200

Project partners
Developer / Owner:
Ethekwini Electricity

Specifier:
Merz and McLellan SA Consulting Engineers

Project manager:
Ethekwini Electricity Transmission Projects

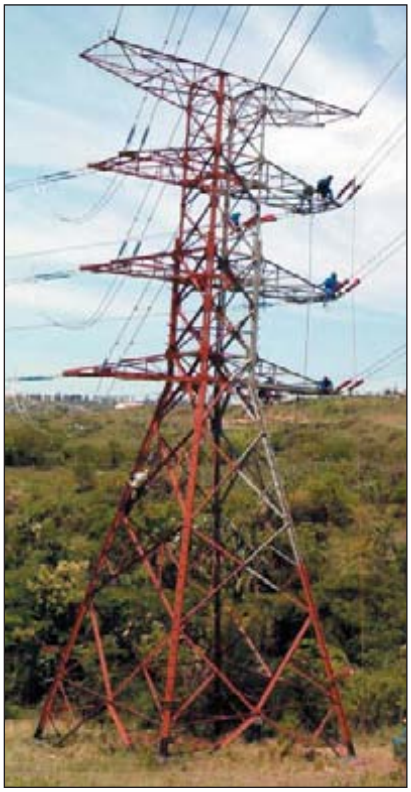
Main contractors:
ABB South Africa, RGF Power Projects, Igunya Power, Jehamo Electrical Contractors

Hot dip galvanizers:
ABB South Africa, Rietfontein General Galvanizers (closed), Belgo Africa (closed), Metalco (closed)

Painting contractors:
ABB South Africa, MAM Projects, Ying Smith Construction, Kopanya Projects

Project inception date:
1990

Project value:
R40 million (approximately)



Saldanha Bay Slipway

Duplex Coating Category

Description
The repair and maintenance of the Saldanha Bay Slipway. The original slipway was designed and built in the late 1960's. As Saldanha is the main centre of the West Coast fishing industry for many fishing fleets such as Sea Harvest, the slipway has been in continual use since its inception. Engineers condemned it in the early part of 2000 due to corrosion of the steelwork and for safety reasons.

Location
Saldanha Bay

Tonnes of steel
200 tonnes of new steel and 75 tonnes of refurbished steel

Project partners
Developer / Owner:
Department of Public Works

Consultants:
Ingcali Consultants and Entech Consultants

Project manager:
Virtual Buro

Main contractor:
Civil & Coastal Construction

Steel manufacturer:
Union Steel

Hot dip galvanizer:
Cape Galvanising

Project inception date
January 2004

Mondi RB 720

Mining and Industrial Category

Description

The Mondi RB720 project is a mill expansion and modernisation project, which was designed to increase the mill's production capacity of bleached eucalyptus pulp by 40% with the incorporation of new equipment, latest innovation and technology into the existing plaint. At the same time it improved the environmental performance of the mill. The project was codenamed RB720, derived from the increased projected tonnage per annum.

Location

Richards Bay

Tonnes of steel

100 tonnes

Project partners

Developer/Owner:
Mondi Business Papers

Architect:
CBI and Jaakko Poyri

Specifier:
Mondi Technical Services / Mill Engineers

Project manager:
Keith Prakke

Main contractors:
Kvaerner, Andritz, FFE Minerals, GL&V, FI Schmidt, MRIP

Hot dip galvanizers:
Bay Galvanising, Phoenix Galvanizing

Project Completion Date

2004

Capaia Winery

Mining and Industrial Category

Description
Hot dip galvanizing is used extensively for the corrosion protection of structural steelwork, walkways, platforms, tank stands, vat hoops, railings and conveyors in the Capaia Winery.

Location
Western Cape

Tonnes of steel
Approximately 100

Project Partners
Developer / Owner:
Capaia Wine Farm

Specifier:
WJB Consultants

Project manager:
CDS

Main contractor:
Triomf Staalwerke cc

Hot dip galvanizer:
Cape Galvanising

Project inception date
2002

The Horn

Architectural Category

Description
A hot dip galvanized steel structure, welded in such a way to represent authentic African wire art.

Location
Kwazulu Natal

Project partners
Owner / Developer:
Africa Centre

Specifier:
East Coast Architects

Artist:
Langa Magwa

Contractor:
Avellini Bros

Hot dip galvanizer:
Phoenix Galvanising

Project inception date:
February 2003

Olwazini Science and Cultural Museum

Architectural Category

Description
The Olwazini Discovery Centre is a science museum located within the Golden Horse Casino Complex in the Scottsville Race course in Pietermaritzburg. The project entails the construction of hand-tailored gabion claddings, onto reinforced concrete columns, providing a rustic look, in theme with the objectives of the museum.

Location
Pietermaritzburg, Kwazulu Natal

Tonnes of steel
1.5 tonnes

Type of steel
Heavily hot dip galvanized mild steel wire, twisted into 80mm hexagonal mesh

Project partners
Developer/Owner:
Golden Horse Casino, Scottsville Race Course

Architect and specifier:
Egg Designs

Project manager:
Egg Designs

Main contractor:
Murray & Roberts, Durban

Hot dip galvanizer:
Cape Gate

Manufacturer and supplier of wire mesh products:
African Gabions

Project inception date
February to April 2002

Project value
R30 000

Bangladesh

Architectural Category

Description
The upgrading of the Bangladesh Market, a fresh produce market.

Location
Chatsworth, Durban

Tonnes of steel
22 tonnes

Type of steel
Lipped channel and custom made tubular sag angles

Project partners
Owner / Developer:
Ethekwini Municipality

Architect:
Urban Architects

Specifier:
Young & Satharia

Project manager:
Dawood Asmal

Main Contractor:
Jay Brown Steel

Hot dip galvanizer:
Phoenix Galvanizing

Project completion date
June /July 2004

Project value
R5.5 million upgrade

The Croft Loft

Architectural Category

Description
An upstairs studio designed to create a spacious and beautiful setting including all the essential amenities. The large sliding folding doors open onto a spacious suspended and covered deck to admit natural light and fresh air. Economy and durability influenced the detailing and choice of materials. The structure was designed to be virtually maintenance free, with all steelwork being hot dip galvanized, a finish that will last more than 100 years in Johannesburg.

Location
Randpark Ridge

Type of steel
300 WA

Tonnes of steel
3.5 tonnes (including roof sheeting)

Project Partners
Owner:
Christine Rankine

Architect:
Rall Architectural Design

Specifier and project manager:
Roderick Rankine

Hot dip galvanizer:
Armco Galvanizers

Project inception date
July 2002

Project value
R203 000

Gateway to Heaven

Innovation / R & D Category

Description
Hot Dip Galvanized steel tray structure for the preservation chamber of a Funeral Service Company.

Location
Umkomaas, Kwazulu Natal

Project partners
Developer / Owner and project manager:
Gobin Bhoora

Hot dip galvanizer:
Phoenix Galvanizing

Project inception date
April 2005

Armco Quadguards for Diamond Hill Toll Plaza — Innovation / R & D Category

Description
Crash cushions installed at Diamond Hill Toll Plaza.

Location
Diamond Hill Toll Plaza on the N4 East

Tonnes of Steel
30 tonnes

Type of steel
Supraform 380 Mild Steel 3mm Thickness

Project Partners
Developer / Owner:
Quixote Absorption System

Specifier:
South African National Roads Agency

Project manager:
Tracc

Sub-contractor:
Armco Road Safety Products

Hot dip galvanizer:
Armco Galvanizers

Project inception date
March 2004

Haygrove Tunnels for Gili Greenwood Holdings — Export Category

Description
Haygrove tunnels are designed to protect crop from hail and rain as well as to create a warmer climate for winter production. In order to protect these tunnels from corrosion they are hot dip galvanized.

Location
Gauteng

Tonnes of steel
330 tonnes

Project partners
Developer / Owner:
Gili Greenwood Holdings

Architect:
Haygrove UK (in-house)

Specifier:
Haygrove South Africa

Project manager:
Margie Hayter / Rudi Jansen van Vuuren

Main contractor:
Gili Greenwood Holdings

Hot dip galvanizer:
Phoenix Galvanizing

Project inception date
2004

Quayside Expansion Project

Export Category

Description
The construction and erection of a hot dip galvanized building on the banks of the Congo River for the loading of cargo aboard various vessels.

Location
Kwanda Base – Soyo Angola

Tonnes of steel
128 tonnes

Type of steel
Structural

Project partners
Developer / Owner:
Saipem S.A.

Specifier:
Kwanda Base – Soyo Angola

Project manager:
Saipen S.A.

Main contractor:
Kwanda Base – Soyo Angola

Sub-contractor:
Clearspan Structures

Hot dip galvanizer:
Armco Galvanizers

Project inception date
March 2004

Adding value to steel for 40 years

The beginning of the Hot Dip Galvanizers Association of Southern Africa

Significant to the development of hot dip galvanizing in South Africa was the founding of the Hot Dip Galvanizers Association of Southern Africa.

The concept of an Association was discussed during a game of golf at the Benoni Country Club forty years ago by Steve Pienaar of African Malleable Foundries (now Salcast) and Walter Barnett of both Rietfontein and Isando General Galvanizers.

In 1965 the Association was registered as an organisation consisting of six member companies all general galvanizers situated on the Reef.

The main purpose of the Association initially was to provide a forum for wage negotiations and other legislative matters as well as the procurement of zinc, which at that time was not produced in South Africa. Initially, the Association was administered by SEIFSA. A full time employee was only appointed several years later when activities expanded substantially.

From left to right: Pierre Versteer (Head of metallurgy - SABS), Brian Callaghan (Research Scientist - CSIR) and Walter Barnett (Chairman of the Hot Dip Galvanizers Association) in the early days.

Meanwhile, with the Association firmly established, plans were underway to expand activities particularly with respect to developing the market for hot dip galvanizing while also concentrating on promoting improved quality standards and service.

Following the International galvanizing conference held in London during 1976. The conference was attended by Ernst Holtz (Managing Director of Monoweld Galvanizers and well known show jumper) together with Walter Barnett, it was decided that the late J.F.H. van Eijnsbergen, Internationally renowned corrosion authority, should be invited to present a series of technical lectures throughout South Africa. Presentations were held in Johannesburg, Cape Town, Durban and Pretoria. This lead to six further visits by Jan in subsequent years

Milestones achieved by the Association

During the early years, before a national general hot dip galvanizing specification existed, Eskom used their own as they felt the BS 729 standard was inadequate for their needs. Their specification was called M1/1-2. However, it became clear that a national specification should be developed and together with, the South African Bureau of Standards (SABS), the Association and themselves, a South African Hot Dip Galvanizing specification (SABS 763) was established. SABS 763 was superseded by SABS ISO 1461 in 2000, and this has been subsequently overwritten by SANS 121. Although for export purposes, ISO 1461 remains in place.

A typical Eskom or municipal pylon. Eskom and most municipalities have for many years specified hot dip galvanizing and where necessary, duplex coatings for the protection of electrical pylons, with tremendous success.

The extensive communication and light mast and pole industry have favoured hot dip galvanizing to protect masts throughout South Africa and northwards into Africa.

The mining industry have, for more than 30 years, used hot dip galvanizing and duplex coatings extremely successfully and this trend improves yearly.

Hot dip galvanizing has proved superior performance in the corrosion protection of overland conveyors. In this photo, the hot dip galvanized coating is still in excess of 80µm after about twenty years of exposure, whereas the other coatings on the idler frames and fasteners have failed.

during which he became well known and respected by both academics and consultants. He was affectionately referred to by some as Sir Jan since he was the recipient of a Knighthood from Queen Wilhelmina of Holland. Jan sadly passed away at the age of 92 in 2004.

He is well known for his book dealing with Duplex Systems (hot dip galvanizing plus paint) which is an outstanding technical publication.

After Jan F. van Eijnsburgen's first visit, activities of the Association began to expand rapidly to the extent that it became necessary to appoint a full time technical employee. Coastal galvanizers as well as tube and wire galvanizers joined the Association together with Iscor the supplier of continuously galvanized steel coil. Zincor, as the local zinc supplier became an active member providing valuable financial support.

One of the most significant achievements was the introduction of hot dip galvanizing and duplex protection in Corrosive Mining applications. This was achieved with the co-operation of the well known Corrosion Consultant Michael Brett. The first fully hot dip galvanized structure in a gold mine was installed at Kinross No. 2 shaft in 1975. It led to the use of hot dip galvanizing extensively throughout the gold, platinum and coal mining industries while a technical paper describing this project received the best paper award granted by the Corrosion Institute of Southern African in 1976.

More than 350 000 tons of structural steel and piping have since been hot dip galvanized for use in corrosive underground mining applications.

Other significant achievements include the extensive use of hot dip galvanizing for structures in electrification distribution, telecommunications, radio transmission, road furniture, concrete reinforcing, steel buildings and numerous others. Some of the projects in the different sectors are: Athlone Stadium, Rasimone and Moab Khotsong Mines, uShaka Marine Park, Belville and Potsdam Taxi Ranks, Capaia and Climor Wineries, SA Breweries in Port Elizabeth, Storms River Bridge and the Unicity in Cape Town.

The development of the duplex system, which comprises painting over hot dip galvanizing, by Jan van Eijnsburgen in the early fifties, is finally gaining momentum in South Africa. The duplex system together with a more recent development, that of architectural hot dip galvanizing, is yielding medium to long term benefits for the industry, due to their improved aesthetic appearance and enhanced corrosion protection.

Hot Dip Galvanizing is now recognised as the most reliable means of corrosion protection for steel in most general applications.

The Portnet Goods Shed in Cape Town, hot dip galvanized some 15 years ago.

Continuously hot dip galvanized sheeting has been innovatively supported by many industries and users over the years.

Likewise, continuously hot dip galvanized wire has also been innovatively supported by many industries and users over the years.

About 85 000 tons of zinc is used for hot dip galvanizing in South Africa annually of which some 25 000 to 30 000 tons is required to galvanize about 450 000 to 500 000 tons of steel and piping alone with the balance required to galvanize small bore tubing, wire and steel coil.

Globally, some 5 million tons of steel is hot dip galvanized annually with between 2 and 2.5 million tons of zinc. This represents about 55% of the worlds total zinc production.

The Association has throughout the years maintained a close relationship with the Corrosion Institute of Southern Africa. Walter Barnett is a past President and recipient of the Institutes coveted Gold Medal Award for outstanding achievement in the development of corrosion technology.

Technical papers have been presented by Association personnel at International Conferences held in Europe, Asia and extensively in Southern Africa.

Logo

The current HDGASA logo is designed to represent two back to back channels forming an H. The arrows pointing in four directions indicate uniform coverage on all surfaces thus providing both barrier and cathodic protection from corrosion.

The three arrows on the right indicate ongoing positive development by way of technical research, education, training and technical marketing.

Membership

From a modest beginning of six members, membership has increased to 53 in various categories.

Publications produced

Steel Protection by Hot Dip Galvanizing and Duplex Systems, Practical Guidelines for Inspection and Repair of Hot Dip Galvanizing, a quarterly technical magazine, "Hot Dip Galvanizing Today", two Duplex Coating Codes of Practice and Design instructions for hot dip galvanizing in the form of a wall chart.

Hot Dip Galvanizing Today, the Association magazine has received accolades for its presentability and technical content and general information from around the world. Two codes of practice for preparation prior to painting and testing duplex coatings have been published with the full co-operation of the paint industry.

The main objectives of the Association

Provision of advice regarding corrosion control in most applications. Where hot dip galvanizing or duplex protection is not appropriate, we recommend an alternative solution.

In-house training for production personnel in galvanizing plants and technical training for sales personnel.

Technical advice and support provided for members.

South African Railways now known as Transnet have for many years successfully used hot dip galvanizing for the protection of numerous structures, including masts.

Hot dip galvanized corrugated steel culverts have provided more than four decades of valuable service to road contractors for controlling drainage of surface water.

Technical assistance for specifiers and end-users in corrosion aspects of major projects.

The Association's reputation as a centre for the provision of technical information and recommendations regarding corrosion problems is well known throughout the industry. Numerous requests for advice and assistance are dealt with on a daily basis by our technical personnel.

History of hot dip galvanizing

The word galvanizing was derived from the name of Luigi Galvani, the Italian physiologist who, in 1786, made the following observation. When bodies of dead frogs were hung on an iron frame by copper wires, twitching of the legs occurred whenever they touched the iron.

Although Galvani believed that the legs twitched because of animal electricity, this theory was disproved by Professor Alessandro Volta. Volta was able to prove that it was in fact current electricity created by two different types of metal and conducted through the moisture or electrolytes in the frogs.

Almost 100 years later hot dip galvanizing, which is the oldest corrosion control process, was introduced in 1836 in France. Since zinc was the metal almost universally used in the 1830's for producing galvanic electricity, Galvani's name was given to the new zinc coating process and it quickly found popular favour.

In 1837 French chemist, Stanilaus Sorel, obtained a patent for a means of coating iron with zinc. A year later a company called English, Scottish and Irish Galvanisation Metal Company was formed, which also applied for patent rights.

Some of the magnificent steel structures that have been created using hot dip galvanizing for corrosion control are:

- The Brooklyn Bridge, which opened in 1883, was the first suspension bridge to use hot dip galvanized wire.
- The Rolls Royce Silver Shadow was launched in 1965. All the parts and structural reinforcement of the underframe assembly were hot dip galvanized in order to protect the chassis.
- The Sydney Opera House is covered with approximately 1 million chevron panels. In order to protect these panels but keep the weight as light as possible, a hot dip galvanized wire mesh was installed on this Australian landmark.
- The space shuttle launch pad suppression system, designed by NASA engineers in the 1980's, consists of hot dip galvanized steel pipes.

The Eiffel Tower shows why lifetime maintenance costs are so important when costing new infrastructure projects.

The sheer size and geometry of the Eiffel Tower places high demands on the corrosion protection and maintenance of the structure. Had the steel used to build the Eiffel Tower been hot dip galvanized before painting, only seven large-scale maintenance operations would have been required, compared to the 17 that have taken place since 1889. Based on today's wage and price levels, a duplex system would have saved at least US$10 million in maintenance costs!

When building for the future, better protect it with zinc!

The birth of hot dip galvanizing in South Africa

The first known uses of hot dip galvanizing in South Africa came in the form of hot dip galvanized corrugated iron sheets, which were manufactured in Britain during 1846 and brought to the Cape by emigrants with the intention of erecting them for housing. In 1851 more sheets were imported to build a large hotel.

In 1873 Paul Kruger built a home on his farm called Boekenhoutfontein in the Rustenburg district. Kruger imported the hot dip galvanized corrugated iron sheeting from Britain only to find that sufficient sheets had not been purchased to cover the entire roof surface area. In his wisdom he inspanned the oxen and drove the ox wagon over the sheets to flatten out the corrugations, with the result that the surface area available was now adequate to cover the entire roof. The latest information available indicates that the same hot dip galvanized corrugated sheets are still in service, over a 121 years old!

A farmhouse in a little town called Tondelbos, about an hour from Calvinia on the Uppington road was riddled with bullets from a skirmish dating back to the Boer war in 1901. Amazingly enough, the original hot dip galvanized corrugated sheeting is still in excellent condition. The rust patches seen in the picture are where the bullets penetrated the sheeting.

Hot Dip Galvanizing in all its forms was introduced to South Africa in the early 1950's.

The rust patches seen on the roof are where bullets penetrated the sheeting. The original hot dip galvanized corrugated sheeting is still in excellent condition after 104 years.

In September 1951, Iscor commenced galvanizing of steel sheet in coil form on one production line. Today four production lines are in operation.

Since inception, more than 16 million tonnes of sheet have been hot dip galvanized. This represents a surface area of hot dip galvanized sheet of about 31 billion square metres. Put into perspective that represents the roof sheeting of a building of about 2.2km wide running continuously from Johannesburg to Cape Town. Tonnage of zinc used is 914 000 tonnes for hot dip galvanizing steel sheet since 1951 with current zinc requirements totalling about 26 000 tonnes per year.

Continuously hot dip galvanizing of wire has been undertaken by wire manufacturers for about 55 years. The amount of wire galvanized to date could be wrapped around the globe at the equator some six or seven times.

Likewise, many thousands of kilometres of hot dip galvanized tubing and small-bore pipes have been supplied since the early 1950's.

The first general hot dip galvanizing operation in South Africa

The first general hot dip galvanizing plant for components other than sheet and wire commenced production in Industria west of Johannesburg 55 years ago. It was the unlikely brainchild of a Johannesburg Real Estate Agent who acquired the licence to manufacture the well-known Braithwate tank plates patented by a Scottish company. These hot dip galvanized tank plates can be assembled to provide large resevoirs for storing water. They are used extensively for the storage of water throughout Southern Africa, at Eskom Power Stations as well as in arid areas such as Botswana and Namibia. The Pearson family who also produced various other types of hot dip galvanized tanks and cylinders eventually acquired this company.

In Cape Town, Consani Brothers opened a hot dip galvanizing plant, a company which was well known in the shipping industry. This was the second general galvanizing company to open its doors.

During subsequent years, general hot dip galvanizing plants sprung up at all main coastal regions as well as the Reef area. Today there is a total of 42 general hot dip galvanizers who galvanize some 450 000 to 500 000 tonnes of steel annually.

The demand for hot dip galvanizing and duplex protection continues to increase due to the reliability, dependability and predictability of this corrosion control method. Valuable technical information and advice is available from the Association or its website www.hdgssa.org.za.

Association Accolades

In celebrating our 40th year of existence and the story that accompanies this event, we felt it was only appropriate that we air some of the accolades that have kindly been sent to the Association, for assistance received over the past few years.

Babcock Materials Handling Africa – following a plant tour – *"Your unbiased views were most useful and constructive."*

Cecil Buys

Eskom – following a presentation at a Corrosions & Coatings Workshop – *"Your role added to the overall success of the day."*

Anton Potgieter

S.A. Canopy Centre – Following a meeting addressing their complaints on the industry's customer service levels – *"We believe you are supporting your sponsors and members in a fair, positive and professional manner."*

James C. Attree

Saldanha Steel – following a report that was submitted – *"We found your technical report to be very thorough, professional and helpful. In future we will not hesitate to recommend you to others."*

Mark Botes

Advanced Galvanising – following a day trip – *"Thank you for planning this trip and spending the day with us despite your heavy work load. We can assure you that this trip was well worth the time to us and not only cleared quite a few things in our minds but also highlighted a few other areas that need attention."*

Theo Brophy

Errol Drake – following a project – *"Thanks for all the support on the project, it certainly was of great assistance and much appreciated."*

Balitmore Aircoil – letter of thanks over the past several years – "May *the Association always be available to provide the support that is so essential for a product in a country where engineering expertise is often not available to operate equipment with design parameters or to diagnose problems accurately."*

Tim Deverson – Managing Director

VHCH Consulting Engineers – following an evening at the Wanderers – *"I really need to attend a few more corrosion lectures."*

Nick Spotswood

Heat Transfer Engineering – following an inspection and report – *"It is most gratifying to know that there are still people like yourselves who are willing to contribute to the enhancement of the industry in spite of the apathy prevailing us."*

B.D. French

Andrag – following visit to Cape Town and receiving Association Literature – *"I would like to confirm acceptance of the technical information you have sent to me and I know it will be useful for educating myself and all our employees. The post for galvanizing practices has already prompted a lot of discussion."*

R.C. McDougall

Bateleur Ores & Alloys – following a meeting – *"Thank you most sincerely for taking the time to explain the Zinc industry to me. If it were not for people like yourself who kindly parted with their knowledge, assignment of this nature would be a nightmare."*

Allan Kuhnert

International Lead Zinc Research Organization Inc. – following a gold mine expedition – *"I thoroughly enjoyed the visit and learned a great deal about the work you have put into making sure that the use of galvanizing is optimised."*

Jerome F. Cole – Past President

Engen – following advice on corrosion protection – *"We have decided to go ahead and galvanize the signs."*

Peter Micklewood

Barloworld Galvanizers – following an inspection – *"You have successfully convinced the customer that the galvanizing was in order and they have now paid us in full."*

Hans Bakker

The South African Institute of Mechanical Engineering – following a Technical Paper – *"On behalf of the Branch, We learnt a great deal and now have a very healthy respect for galvanizing and its applications in industry."*

Allan De Wet

Development Policy Research Unit - University of Cape Town – following a meeting – *"I appreciate your openness and interest in the work done on the metal finishing industry, and the time spent to accommodate me in your busy schedule. Your views and input are an important contribution to our project, and your helpfulness is held in high regard by all the project members."*

Eckart Naumann

Brecht Dinkie Holm – following the hot dip galvanizing of the steelwork for a Biodome – *"Thank you for assistance and technical advice on the application of hot dip galvanizing. The readily compatible appearance in this application on the biodomes was an important factor in deciding on hot dip galvanizing."*

Albrecht Holm

Cape Galvanizing – following advice – *"Thanks for your assistance in getting the engineers to change their corrosion protection system from shot-blasting and painting to hot dip galvanizing. The project is one of the*

biggest buildings we have galvanized and completed well ahead of schedule."

Ian Dodds

Amalgamated Reinforcing Cape Branch – following a report – *"Your association definitely gave valuable input with regard to our problem."*

Grant Daniels

Murray Diesel – following a plant tour – *"Thank you for the excellent presentation and tour of the works. Everyone enjoyed it and thought it was worthwhile. They all now have a good grasp of the benefits of galvanizing and know who to contact if they have questions."*

Christa Roberg of Radmaste Centre – following a plant tour – *"Thank you for your warm reception and taking our Eastern Cape group on a tour of a hot dip galvanizing operation. It was fascinating and we all learnt a lot. It particularly struck me how one takes things for granted in ignorance."*

Consolidated Galvanizing Services – following a presentation to customers – *"It was clear that everyone that attended found it an extremely valuable day. Your knowledge of the product and industry is unsurpassed and well respected."*

Johan Coetsee – Managing Director

Marley Flooring – following a recommendation – *"Thank for your recommendation for the corrosion protection of the tank as per your fax. It is much appreciated."*

Bill Parker

ConGalv – following the Golf Day – *"On behalf of the ConGalv team we wish to express many thanks for the superb Golf Day. The event was very well organized and feedback from our customers has been outstanding. Keep up the good work."*

Johan Coetsee – Managing Director

BMA Fasteners - Bulawayo – following a Seminar – *"You shared some invaluable information and knowledge with us, which we hope to apply to good effect in our hot dip galvanizing operations. Also thanks for the suggestions on improving output from our process."*

Vusa J. Sibanda

Bateman BMH – following a presentation – *"Thank you for a most informative and professional presentation. We will certainly take you up on your offer in an advisory capacity should the need arise."*

SA Pipe Kits – Robert Lonsdale – following a legal battle – *"I was not aware of the Association until 2 weeks ago, but will certainly not forget, and will make certain that in my future dealings with clients, the Association will be spoken about."*

Engen Oil – Malcolm Smith – following a presentation – *"Congratulations and thank you for your very fine effort in putting across the finer points of galvanizing. You made it interesting and easier for the Engineers and drawing office personnel to understand the process / fabrication. It is only by visits like this from the HDGASA that the message will eventually get through."*

Hot dip galvanizing of high strength low alloy steels

A question sometimes raised by engineers and others is that can high strength low alloy (HSLA) structural steels be hot dip galvanized without the heat of galvanizing at 450°C compromising the steels mechanical properties? The answer to this question is quite simply YES.

HSLA steels have as-manufactured yield strengths up to 500MPa and some low alloy grades that are quenched and tempered up to 700MPa. These steels are used in buildings, bridges, mining structures, offshore oil and gas platforms, etc. They have excellent weldability and resistance to brittle fracture in service and can be hot dip galvanized without loss of any of these properties. The use of HSLA steels can result in lower construction costs from reduced steel weight and also lower fabrication and operating costs from reduced weight/lower fuel cost e.g. in transport, or a higher carrying capacity.

The high as-manufactured yield strength and inherent toughness of these steels results from may years of worldwide research over the past thirty years or so. Constructional steels are nowadays rolled to lower finishing temperatures for a smaller grain size and there is controlled cooling after rolling for the appropriate steel microstructure. These advances together with addition of small amounts of titanium, niobium and vanadium to create precipitation strengthening effects during manufacture; non-metallic inclusion shape control for improved transverse properties and close control over any embrittling elements has resulted in an outstanding family of constructional steels being available. The higher strength steels that are cooled from the rolling temperature fast enough to harden the steel are subsequently tempered typically in the range 620-690°C.

In conclusion all HSLA steels can be heated up to about 600°C without any loss of properties – hence hot dip galvanizing at about 450°C is safe and can be considered as the method for corrosion protection.

The Association wishes to thank Prof. Denis Twigg for his contribution. Denis is an Honorary Life Member of the Association

Much more than a fence

By Norman Tregurtha (CEO of Fairmile Fencing SA (Pty) Ltd)

The steep increase in break-ins, vehicle highjacking and increased use of violence to readers of Hot Dip Galvanizing Today, is alarming news, especially when it is combined with other incidents such as terror attacks.

In industries such as ours, risks have reached new heights and dimensions. Unlike in wartime, when the risks were obvious, today there is no clearly defined enemy. There is no face, no nationality, no identifying marks whatsoever, to tell us who the enemy is and where or when he might strike.

Anglo Platinum Mines, Rustenburg.

All of this makes vigilance and discipline two fundamental requirements for securing the lives and property placed in the hands of the Steel Palisade Manufacturers. We take a look at what should be done to protect our business partners and consumers and their goods from attacks of any kind.

Palisade fencing

The concept of Palisade Fencing is not a new idea; it's been around for decades. The resurging in popularity is due to a number of factors:

- It allows security personnel to monitor suspicious movements both inside and outside the perimeter.
- The minimal inter pale spacing allows visibility of displayed goods without compromising security.
- It combines strength and economy.
- It generally has a good appearance.

Whatever the reason, the market has boomed in recent years and the confirmation of this is the boundary of most Municipal Premises, Office Parks, Industrial Parks, Golf Courses, Factory Complexes and increased Residential Applications.

Carnival City Casino, Brakpan.

It's a small wonder that this industry has been so successful, without the discipline of regulation. Unlike South Africa the British fencing industry is regulated by means of their BS1722 specification, which consists of 15 parts, which regulates all types of fencing ranging from Part 1 Chain Link to Part 15 Noise Barriers. Part 12 relates to Palisade Fencing.

This specification was put together by a technical committee from 28 bodies ranging from the British Steel Industry, Department of Environment, National Council of Building Materials, Department of Transport, Institute of Clerk of Works and a host of other.

The purpose of this standard is to establish minimum requirements for materials and workmanship for the more common types of fence in order to ensure satisfactory service for the purchaser, and to assist manufacturers and erecting contractors by eliminating unnecessary minor variations in the demands of purchasers. It specifies requirements for the components that make up a fence and the way in which the fence needs to be constructed. Throughout this standard there are requirements for sizes of components, together with the permissible tolerances on size. These are minimum requirements and it will normally be acceptable to use larger sizes, except where it would otherwise adversely affect the fit of components or where replacement parts need to match up with those already present.

The choice of a fence is affected by factors such as the intended purpose of the fence, the desired service life, aesthetic considerations and the availability of components. The specifier of the fence will know its intended purpose and by reference to their tables a suitable choice can be made. This then gives those erecting the fence the basic characteristics that

MUCH MORE THAN A FENCE

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- ☑ High quality South African steel for all components
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- ☑ Is the most durable product in its class
- ☑ Can be manufactured in anti corrosive alloys for aggressive enviroments
- ☑ Competitively priced
- ☑ Conforms to British Standard BS 1722.
- ☑ Reliable perimeter control
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- ☑ Durability
- ☑ Early warning capability
- ☑ Full electrification
- ☑ Alarm triggered
- ☑ Energised 10 000 volts
- ☑ Monitoring network
- ☑ Data storage
- ☑ SMS alert
- ☑ CPRS monitoring

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Fairmile Fencing (Pty)Ltd.

Innovation Hub, Pretoria.

need to be provided. This standard includes requirements for protective treatments. However, an important aspect of providing an extended service life is the maintenance of the fence after its erection; this is outside the scope of this standard. Premature failure can be avoided by taking care not to damage protective treatments during installation.

In South Africa however there are not many benchmark companies who offer the minimum requirement as required by the British specification. Factors that should be taken into account when designing a Palisade Fence are as follows:

General

- Scope
- Dimensions and general characteristics

Materials

- Steel
- Bolts, nuts and washers
- Rivets
- Cold swaged pin and collar fixings

Constructions

- Pales
- Posts
- Stays
- Rails
- Post to rail connections
- Intermediate supports
- Protective treatments
- Renovation of coatings

Foundations and sills

- General
- Holes for fence post foundations
- Concrete sills
- Concrete for post foundations

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- Gate posts

Erection
- Line and level
- Posts
- Intermediate supports
- Bolts and fastenings
- Erection of palisade fences

Appendices
- Method of test for determination of the characteristic flexural strength of pales
- Specifying a palisade fence
- Method for determination of tensile strength of cold swaged pin and collar fixings

Tables
- Typical pale thickness
- Basic dimensions for general palisade fences with posts at 2.75m centres
- Holes for fence post foundations
- Frame sizes of steel palisade type gates
- Sizes of steel gate posts (RSJ or universal column) for steel palisade type gates
- Sizes of steel gate posts (RHS) for steel palisade type gates
- Fittings for steel palisade type gates
- Dimensions for gate fittings
- Fastener hole diameters

Figures
- Corrugated pale top shapes
- Angle pale top shapes
- Typical gate components
- Arrangement of loading of test specimen
- Pull-out test arrangement
- Push-out test arrangement

Apart from all of the above the need for early warning detection systems have been incorporated to enhance the above specification notable:

- Wall Top Electrisade
- Split Fence Electrisade
- Free Standing Electrisade

Which offers the addition of the following services:

- Reliable Perimeter Control
- Early Warning Capabilities
- Full Electrification
- 10 000 Volt Non Lethal Pulse

together with Data Storage, Maintenance, Insurance rebates, Rental Facilities, Customised Applications, Contracted Armed Response Monitoring, SMS Alert, GPRS Monitoring, Aerial-support Response, Asset Control and Management.

It is with the above in mind that one of these benchmark companies Fairmile Fencing SA (Pty) Ltd has been working in conjunction with MITTAL Steel SA to achieve these requirements. In that they have developed a pale that meets with the requirements of BS1722-12-1999 and is now readily available from source and to date more than 1000t of these pales have been sold, 90% of which has been Hot Dip Galvanized for the use in the local market.

There is a great need for this industry to enhance its position from a shady past by establishing minimum requirement for materials and workmanship for Steel Palisade Fencing.

Editorial comment:
The BS 1722 *specification has been reproduced by South African National Standards as* SANS 301 *part* 12 – *Specification for steel palisade fences.*

Provicom Electronics has merged with Alcatraz Security, East London

"Provicom Electronics, a division of the Bidvest Group, one of South Africa's leading companies on the JSE has acquired Alcatraz, focusing on delivering a service to the growing electronics security market. Being part of the Bidvest organisation means offering solutions throughout the commercial and industrial sector of South Africa.

Alcatraz, has become Provicom East London, and will focus their attention on providing the market with quality material, perfection in workmanship, the latest technology and 20 years of experience. This strategy encompasses specialist designing of customised systems to address the clients specific security needs. All sites are thoroughly surveyed and scrutinized to find the best possible solution.

While focusing on the client, Provicom East London has another target area, job creation. They provide work for local labourers from the male and female gender, zooming in on service delivery and after sales service.

Ultimately, Provicom East London has become one of the corner stones of the company and their areas of expertise are; Perimeter Control, Access Control, CCTV, Fire Detection, Audio & Evacuation systems as well as Perimeter Surveillance.

Their integration into the Bidvest Group gives them the financial muscle to offer different payment and maintenance options which is part of their market differentiation strategy. Provicom East London have a variety of ways to make their products cost effective, and in so doing provide the best value for the client whilst satisfying all their electronics security needs.

"Provicom East London, don't think they are the best, they know they are the best."

Hot dip galvanizers 'captive' palisade fencing market in the Cape?

Hot dip galvanizing company executives in Gauteng must fantasize about a sudden unexplained climate shift, which transfers the Cape weather to their area bringing with it an endless procession of fencing companies who no longer ever sell an ungalvanized fence.

Cape Palisade Fencing has been the sole distributor of Boksburg based Augusta Profiles' Palisade products in the Western Cape for the past 5 years and of the thousands of tonnes of fencing which we have manufactured and installed, we don't recall ever having sold an ungalvanized fence. Magic! The clients don't even consider the additional cost of fencing and pay up happily. Fencing companies have an added value component from which to profit and never have a corrosion comeback. And the galvanizers are smiling. Sounds like heaven? Not quite. It's not hell either but additional components in the client / fence supplier / galvanizers chain require careful management. Consider some of these points.

Clients rarely understand that hot dip galvanizing is an industrial coating and not a decorative finish and are often disappointed with the aesthetics, even of "well galvanized" materials.

Clients baulk at the high cost of final paint or powder coatings due to a lack of insight into how expensive it is to correctly wash and prepare hot dip galvanized materials and the need to use primers and other coatings to achieve reliable finishes.

Clients are left to grapple with the dilemma of which fencing company to believe, regarding the extravagant

Close up of Augusta Profiles latest pale design distributed by Cape Palisade Fencing in the Western Cape.

claims made by "Zincalume" afficionados with their carefully understated 1.2mm thick materials on the one hand versus the dismissive arguments of the hot dip afficionados with our technical rambling which somehow always seems to end up sounding like "techno-babble".

Cape Palisade Fencing and Augusta Profiles have been fortunate in having developed a close business relationship based on trust and integrity. Relationships like this are rare in today's business environment. Quality of materials is essential for successful hot dip galvanizing but we are constantly under pressure to match prices in a highly competitive and cut throat market. Margins in this environment are always tight as both supplier and distributor together try to provide the best quality at the cheapest possible price.

Having to hot dip galvanize adds a whole chain of additional cost and management factors such as administration, transport, material-handling, quality control, cleaning and corrosion guarantees. As most galvanizers require prompt payment for their services, a fencing company such as ours can experience cash flow problems when clients drag their heels in settling major project accounts, which again extends the manufacturing / installation cycle.

And what about the hot dip galvanizers' captive market?
The surface-area to weight ratio of fencing panels combined with the relatively thin materials and awkward shapes and sizes does not make fencing the most profitable thing to hot dip galvanize. A six tonne truck will carry 6 tonnes (or dare I say, 8 tonnes) of structural steel but only 2.5 tonnes of fencing panels. That same truck of structural steel will be off-loaded in ten minutes with a forklift or gantry using 2 people versus 45 minutes using 4 or more, for fencing panels.

6.4 km palisade fence around Pearl Valley Golf Estate: *Augusta palisade materials, manufactured and installed by Cape Palisade Fencing, contract value of palisade R4.2 million.*

Close-up of completed palisade fence.

How profitable do you imagine the galvanizer is when he must individually wire up 600 post brackets, which weigh about 60g each, or to find them later among a 20 tonne stack of other items?

The unreasonable aesthetic expectation of the end-user normally results in the galvanizer spending endless time and energy on educating clients, testing their diplomatic skills with clients that feel they want the finish to resemble the stainless steel front grid of a Bentley, in spite of the fact that the original material supplied was stamped "Reject-Siberian Grade F".

While you decide whether you would want a piece of the Cape's hot dip galvanizing heaven, I can conclude that when all is taken into account, I derive a certain smug pleasure from asking the client who has just handed me a cheque for their new fence whether they were planning on moving. The answer invariably is…., "no, why?" "Oh good," I say "then I'll expect to hear from you again in 25 to 30 years time".

Hot dip galvanized products used in the electric fencing industry

Electric Fencing, as most Security Products, are generally considered as grudge purchases by all and for this reason, aesthetics plays an important role in the installation of Electric Fencing.

The general consensus being that if one is forced to install an Electric Fence, keeping ones hard earned possessions and loved ones safe, the Electric Fence installation should at least be neat, presentable and free of premature discoloration and ideally long term corrosion.

Area's away from the coast and not exposed to corrosion resulting from micro chemical environments, have been fortunate enough to get away with the installation of Powder Coated or even painted brackets in the past.

Since Nemtek introduced Hot Dip Galvanizing to their range of brackets they have been able to confidently offer their full range of products, as a cost effective alternative to powder coating and painted brackets, to virtually all regions of South Africa.

Since the introduction of Hot Dip Galvanized products, they also confidently export their range of products to numerous countries abroad.

Recently, Nemtek have been able to offer their range of brackets as Duplex Coated (Hot Dip Galvanized and Powder Coated) for coastal regions. The combination of hot dip galvanizing and powder coating provides enhanced corrosion protection while offering the client an aesthetic finish.

Currently the following range of products are offered by Nemtek in Hot Dip Galvanized and Duplexed form: Round Bar, Flat Bar and Square Tubing Brackets, Profile Poles, T-Poles, S-Hooks, Earth Spikes, Line Clamps, etc.

It is with confidence that Nemtek now can truly say that they offer a bracket solution to virtually all applications, thanks to Hot Dip Galvanizing and Duplex Coatings solutions.

For further information regarding any of the Nemtek range of Electric Fencing products, kindly contact Nemtek on (011) 462 8283.

A typical hot dip galvanized support of an electrified fence.

Some design shortcomings and successes of security fencing

Following on my editor's note, when specifying a fence for security reasons there are many details to address in order to achieve success. Pictorially, we highlight some of the design shortcomings and some of the successes.

Inadequate substrate preparation, inappropriate or incorrect corrosion protection material and paint touch-up discoloration.

Insufficient corrosion protection with little or no maintenance or inordinately excessive service life with regard to the environment at hand.

Poor erection and inappropriate site alterations.

Well manufactured, excellent corrosion protection, good erection and finishing on site.

MISCONCEPTIONS

Miss Conception puts it "straight"

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

On the occasion of the 40th Anniversary of Hot Dip Galvanizers Association Southern Africa it is perhaps appropriate to dispel any ***misconceptions*** that the Association exists solely for the purpose of selling hot dip galvanizing. In any case, galvanizing for corrosion control is a concept that tends to sell itself, due to its successful performance in numerous applications recorded throughout past years. In fact, not only does it sell itself, it also forms itself. All that is required is a spotlessly clean chemically treated surface and the fascinating metallurgical laws of nature take over to form the protective coating.

Of course it would be wrong were we to deny that one of the main objectives is to encourage the use of hot dip galvanizing for corrosion control in applications where, based on both documented case studies as well as technical expertise and experience it should be regarded as the most cost effective choice.

To describe the Association, as a marketing organisation is perhaps correct, bearing in mind that we have many other objectives of equal importance. We prefer to preface the word marketing with the word technical since our stated policy is only to recommend hot dip galvanizing for use in applications where this can be justified by technical facts and substantiated by past case studies.

Association personnel are technically accomplished in the fields of corrosion science and corrosion control. This has resulted in numerous technical papers being presented by Association personnel at International corrosion as well as hot dip galvanizing conferences both in South Africa and elsewhere throughout the world. The Association maintains a close relationship with the Corrosion Institute of Southern Africa while also contributing extensively to the Institute's activities in training programmes and technical presentations.

What then are the objectives for the continued existence of an Association such as ours? Plainly, the Association has a responsibility to ensure that hot dip galvanizing is selected for corrosion control wherever this can be technically and cost effectively justified.

In achieving this goal, a broad strategic plan has been in place for many years. It embraces activities, which we consider to be extremely important. Let us consider some of these activities.

Monitoring the performance of Hot Dip Galvanizing in Specific Applications: This is undertaken on an ongoing basis. To illustrate, a concrete structure in the corrosive sea spray zone in Port Elizabeth was recently demolished for reasons other than corrosion. Samples of the concrete containing hot dip galvanized reinforcing steel were subjected to laboratory tests which revealed that despite significant chloride penetration into the concrete cover, the zinc coating had provided adequate protection to the underlying steel for several decades. This is but one of many case studies that have been documented which provide reliable decision-making information for specifiers (see Case History on page 50).

Failure Investigations: In a recent case, corrosion of hot dip galvanized fittings and valves installed in a 600km pipeline was brought to our attention by the responsible consulting engineers. Our investigations established conclusively that the cause was microbially influenced corrosion as a result of the presence of sulphate reducing bacteria. At the conclusion of this investigation, a complimentary e-mail was received from the consultant in which he said "First of all, thank you very much for your kind effort. It is extremely seldom that you find people willing to travel in excess of 1000km to provide assistance in the investigation of what some will perceive as a minor problem. Your passion for the subject of corrosion and the protection against it by means of hot dip galvanizing is infectious."

Research and Development: The concept of duplex protection by combining the attributes of hot dip galvanizing with those of an organic paint system are well known. The development of a single coat heavy-duty paint system with the required adhesion properties when applied onto a hot dip galvanized surface, has reached an advanced stage.

Capital Project Planning: The Association is regularly consulted for professional assistance at the planning stage for new major projects. To illustrate, advice was requested at the planning stage for a new ultra-deep gold mine in the Klerksdorp district. Extensive practical tests were undertaken including the analysis of potentially corrosive mine water and the study of maximum temperature and humidity levels at a depth down to about 3km below the surface. This technical investigation indicated that hot dip galvanizing would provide maintenance free corrosion protection for at the very least twenty five years. After 10 years in service, this prediction would appear to be an accurate one.

Education and Training: A very important responsibility of the Association is the provision of training courses for coating inspectors and production personnel both for Association Members and other organisations. The Association also provides hot dip galvanizing Members with technical advice regarding plant and equipment, the control of pre-treatment chemicals as well as production processing methods.

Plainly, to describe the Association as merely a marketing organisation is a ***misconception***. Technical marketing is but one of several other extremely important activities.

Hot dip galvanizing for general and architectural purposes

Amended August 2005

The achievement of a quality hot dip galvanized coating, for general and architectural use, is dependent on many issues, some controllable and some not. This checklist addresses the issues that can be controlled by the designer and those controllable by the galvanizer.

AG – *Architectural Quality additional to* SANS 121 (SABS ISO 1461)

GG – *Normal General Hot Dip Galvanizing to* SANS 121 (SABS ISO 1461)

Y/N – *Was this criteria achieved, yes / no?*

#1: SPG – *"Steel Protection by Hot Dip Galvanizing and Duplex Coatings" or "Design for Hot Dip Galvanizing", wall chart, contact the Association for a copy. The latter publication is free plus postage.*

#2: *Provided the primer is applied shortly (within 4 hours in moist conditions and within 8 hours in dry conditions) after hot dip galvanizing has been carried out, passivation by the galvanizer should be excluded. This step in the process is extremely important, if intercoat adhesion is to be achieved. If application of the paint coating cannot be guaranteed to be applied shortly after hot dip galvanizing and particularly in moist environments, passivation by the galvanizer should be encouraged. The reason for the latter instruction is to prevent the formation of wet storage stain, which is difficult to remove prior to painting.*

#3: *In the case of large contracts, the galvanizer should be involved at the programming stage with the fabricator and the end user. Hot dip galvanizing is normally the final process after fabrication and prior to delivery and erection. If sufficient time for hot dip galvanizing, cleaning, fettling and inspection is not provided in the overall programme, costly delays may occur at the erection stage.*

#4: *A certificate of conformance is required to ensure that all fettling prior to coating inspection is done by the galvanizer and not by other parties.*

NOTE: THIS CHECKLIST IS TO BE USED AS A GUIDELINE AND ALTHOUGH FAIRLY COMPREHENSIVE, SUITABLE INFORMATION MAY STILL BE ADDED.

No.	THE SPECIFIER AND DESIGNERS CRITERIA:	AG	GG	Y/N
1	Discuss requirements with Hot Dip Galvanizers Association Southern Africa and/or the selected galvanizer/s before designing commences.	P1	P1	
2	The specifier or designer to ensure all steelwork contractors are informed in writing of the architectural hot dip galvanizing requirements prior to the finalisation of the tender.	P1		
3	Make use of an Association Galvanizing Member.	P1	P1	
4	Make the requirements known to the galvanizer, **in writing**, together with a sketch or sample, before placement of the order. Further discussion with the galvanizer may be required.	P1		
5	Make use of the Association wall chart- "Design for Hot Dip Galvanizing". **# 1**	P1	P1	
6	Choose correct steel type – see table on page 42. If possible all parties related to the project to purchase the specified steel from the same or specified suppliers. Insist on the steel chemical analysis certificates for record purposes and issue copies to the galvanizer.	P1	P1	
7	Insist on the steel chemical analysis certificates from the steel supplier, for record purposes and issue copies to the galvanizer.	P1	P1	
8	Ensure components can be dipped in a single immersion or alternatively discuss the impact of double end dipping with the selected galvanizer / Association.	P2	P2	
9	Optimize size of filling, draining and vent holes, see SPG or wall chart. **#1**	P1	P1	
10	Optimize position of filling, draining and venting holes, see SPG or wall chart. **#1**. If necessary unwanted holes can be closed after hot dip galvanizing, contact the HDGASA for details.	P1	P1	
11	Should painting of the hot dip galvanizing be specified, ensure that instructions stating "No passivation is required – substrate is to be painted", is handed to the galvanizer, at order stage, unless specifically discussed and excluded. **#2**	P1	P1	

No.	THE SPECIFIER AND DESIGNERS CRITERIA:	AG	GG	Y/N
12	Select significant surfaces, highlight on drawing or sketch and discuss with galvanizer / Association.	P1	P1	
13	If necessary, hot dip galvanize a sample and establish acceptance / rejection criteria.	P1	P1	
14	Specify the correct temporary-marking pen for fabrication marking. (A 50/50 PVA paint to water mix, works well for temporary marking)	P1	P1	
15	Ensure that if permanent marking, such as welded lettering is used it will be appropriately hidden from final view.	P1		
16	Specify all flame cut edges to be thoroughly ground, ideally 2mm into the parent material.	P1	P1	
17	If deemed necessary, to minimize handling damage ensure correctly positioned lifting lugs are provided or if not acceptable, soft lifting slings are used, by all parties, including the galvanizer, the transporter, the off loader and the erector, etc. The use of the former is possibly more appropriate.	P1	P1	
18	Specify welding that is fit for purpose; do not allow over weld.	P2		
19	Should stick welding be used, ensure that all weld slag is comprehensively removed by abrasive blasting of the weld area or grinding prior to delivery to the galvanizer. (Excessive weld porosity can have a marked effect on the quality of the hot dip galvanized coating).	P1	P1	
20	If the build-up of zinc at a weld is unacceptable for aesthetical reasons, request that the correct welding wire or rod be used. Some welding materials are reactive wrt hot dip galvanizing and can result in a thicker coating on the deposited weld. Discuss with the HDGASA.	P1		
21	Simplify componentry – Simple structures – Better coating quality Complex structures – Harder to manipulate in the galvanizing bath, more control, cleaning and fettling necessary.	P1	P1	
22	Simplify complex structures by making use of bolting where possible or alternatively design for after galvanizing welding, by using a suitable mask such as "Galvastop", which can be easily cleaned, successfully welded and correctly repaired.	P1	P1	
23	Discuss packaging / dunnage requirements with the galvanizer during transport and ensure that ample site stacking facilities are provided. A hot dip galvanized coating is applied in a factory and then transported to site where frequently the components are thrown off the truck. Inappropriate offloading may lead to unnecessary mechanical damage of the coating. As the components are generally not wrapped, coating discolouration due to contaminants being deposited by wet trades, i.e. angle grinding of wet clay bricks in the presence of hot dip galvanized components, should be prevented.	P1	P2	
24	Discuss the appropriate repair method, if repair is deemed to be necessary, with the galvanizer. Silver spray paint is not acceptable. The silver spray paint may be initially more aesthetically acceptable while the hot dip galvanized coating is shinny, but will ultimately stand out and be aesthetically unacceptable, when the hot dip galvanized coating begins to weather to a matt dull grey appearance.	P1	P1	
25	Discuss the maximum size of coating repair area allowable when alterations or adjustments are made on site, with the appropriate contractors.	P1		
26	Discuss inspection of the components prior to these leaving the galvanizer's premises.	P1	P1	
27	Ensure that a certificate of conformance in accordance with the specification has been obtained from the galvanizer. #4	P1	P1	
28	Ensure that selected galvanizers use their appropriate identification paint, (if acceptable to the client) before delivering the components to site. Furthermore, identification paint is to be applied only to areas identified on the drawings by the architect or consultant, or if not available in non-significant areas, particularly if the component is **not** to be over coated with a paint system.	P2	P2	
29	Allow sufficient time for the hot dip galvanizing process to take place, ideally 3 to 7 working days, unless other arrangements have been made. **#3**	P1	P1	

Checklist for architectural hot dip galvanizing

No.	THE GALVANIZERS' CRITERIA:	AG	NG	Y/N
1	At the tender stage, enquire whether the components are to be hot dip galvanized to an architectural standard. If yes, ensure that the enquirer understands the specifier and designers criteria and has a copy of this check list.	P1		
2	If an architectural finish is required, obtain a sketch indicating significant surfaces or a sample which may be hot dip galvanized, for discussion purposes.	P1		
3	Insist on the appropriate steel chemical analysis certificates for galvanizing control and record purposes.	P1	P1	
4	Ensure that significant surfaces if necessary have been discussed and agreed on.	P1	P1	
5	Ensure components can be dipped in a single immersion, unless discussed with the fabricator / customer / specifier or the Association.	P1	P1	
6	Ensure when offloading plain steel components, that any transport damage is recorded and the client appropriately notified.	P1	P1	
7	Ensure that reasonable fill, draining and vent holes have been provided.	P1	P1	
8	Ensure that filling, draining and vent holes have been positioned correctly.	P1	P1	
9	When handling the component, make use of the lifting lugs if supplied or alternatively use soft lifting slings after hot dip galvanizing.	P1	P1	
10	Ensure the use of optimum aluminium content in the zinc bath.	P1	P2	
11	Based on the chemical analysis of the steel, discuss immediate water quenching after galvanizing, if necessary to limit iron/zinc alloy build-up with reactive steel. The galvanizer should also be aware of the increased likelihood of distortion with certain components when quenching and discuss these with the customer/ Association.	P1	P1	
12	Ensure all agreed upon significant surfaces have been cleaned and free of imperfections after hot dip galvanizing, according to instructions.	P1	P1	
13	Ensure adequate fettling of the components using appropriate methods, particularly with reference to lumps, runs and excessive surface roughness, especially on significant surfaces, while taking care not to excessively clean the surface, leading to uncoated areas.	P1	P1	
14	Zinc spray paint is not acceptable. Ensure that the specifier is informed of the method of renovation of uncoated areas that might occur due to air entrapment during galvanizing or as a result of mechanical damage at the galvanizer.	P1	P1	
15	Water quench if necessary to limit iron / zinc alloy build-up with reactive steel. Passivating chemical not to be present in quench water if subsequent painting is required. See **#2**	P2	P2	
16	Ensure that inspection of the components is carried out before and after hot dip galvanizing, to the customers requirements. Issue a certificate of conformance after hot dip galvanizing.	P1	P1	
17	Ensure that any identification paint used by the galvanizer, (unless specifically excluded by the client) is applied in an agreed upon location, or on a non-significant surface of the component.	P1	P2	

Editorial Comment to the Architectural Check List

The architectural check list is obviously first prize in achieving quality hot dip galvanized coatings (architectural quality) and may be difficult to achieve in all instances, however it forms an excellent guideline as to what can be achieved in practice.

The MTN Head Office project in Fairland, see Awards Event, was a project that initially utilized this check list and although not quite a 100% successful in achieving architectural hot dip galvanizing in all instances, there was a considerable degree of success.

Greater success in achieving architectural hot dip galvanizing will only be forthcoming when the specifiers and galvanizers alike communicate effectively and adhere to the requirements of this check list and possibly the introduction of a nickel based alloy to the galvanizing bath.

IDEAL STEEL FOR HOT DIP GALVANIZING
INDUSTRIAL AND MINING APPLICATIONS
• Silicon (Si) – 0.15 to 0.3% Max
• Phosphorus (P) – 0.02% Max
ARCHITECTURAL APPLICATIONS
• Silicon (Si) – 0.03 Max with Phosphorus (P) – equal or less than 0.01%
Or
• Silicon (Si) – 0.15 to 0.25% with Phosphorus (P) – equal or less than 0.02%

Armco supplies corrugated metal culverts for the rehabilitation of National Route 2 between Kareedouw and Humansdorp

Hot dip galvanized corrugated metal culverts were supplied and constructed during the project in the late 1970's. Subsequent inspections during the 1980's showed that some of the culverts showed sign's of corrosion at the invert level due to somewhat aggressive waters possibly from farming activities and the abrasion of debris. Isolated corrosion was also found at some soil/steel interface areas, due to aggressive soils and these components were replaced.

Approximately 15 of the hot dip galvanized corrugated metal culverts were left in place and operated until they were inspected as part of a project to reseal the National Route. The size of these culverts, range from 600mm in diameter up to 6 200mm span by 4 000mm high ellipses.

One of the 15 culverts was found to be completely sound and left in place. 13 Culverts were re-lined with new corrugated metal culverts and the voids between the old and the new culverts were grouted with cementitious grout. The largest of the metal culverts was rehabilitated using reinforcing mesh and gunite.

The relining process used consisted of pulling in the new hot dip galvanized culverts with turfors over steel guardrails. The new metal culverts were assembled in segments on site and pulled in using 3m lengths. Bolts were placed at convenient and consistent spacing with welded nuts to locate the culverts centrally in the void. Fine cementitious grout was then pumped into the void between the old and the new metal culverts. Adequacy of grout was monitored by having holes in the metal culverts at intervals by which the compaction of the grout could be monitored.

The new culverts were then sealed by painting the inside hot dip galvanized surface with a rubberized bituminous sealant. The inverts of the new structures were paved with concrete liners and the interfaces sealed with bituminous bandages. Ring beams were constructed where necessary to protect the inlets and outlets along with other concrete and gabion structures.

The relined Armco hot dip galvanized corrugated metal culverts are expected to extend the service life of the old structures by many, many years.

CLIENT:
South African National Roads Agency Limited

MAINCONTRACTOR:
Haw & Inglis

STRUCTURAL CONTRACTOR:
Lesiba Construction

GROUTING CONTRACTOR:
Esor

SUPPLIER:
Armco Superlite

New hot dip galvanized structure assembled inside old structure.

Relined structure after grouting.

Walter's Corner

Hot dip galvanized metallurgically bonded protective barrier

In the corrosion control industry, the term protective coating implies the provision of a protective barrier in order to prevent contact between the underlying material and corrosion inducing substances in the environment where it is situated. This is described as "barrier protection".

Protective coatings are produced from a vast variety of both organic and inorganic materials in order to combat corrosion in conditions, which vary from one application to another.

A prerequisite for the success of all protective coatings is adequate surface preparation of the substrates onto which they are applied. Inadequate surface preparation will result in inferior coating adhesion while with paint coatings, the presence of surface contaminants such a mill scale, can initiate the formation of corrosion cells at the interface between the parent metal and the coating.

As in the case of all other protective systems, adequate surface preparation is an essential requirement for the successful application of a hot dip galvanizing coating, if coating uniformity and adequate adhesion are to be achieved. But here is where the unique difference lies between a coating applied by hot dip galvanizing and the other protective systems.

If we consider the importance of coating uniformity and continuity, it is necessary to understand the somewhat unique mechanism whereby a hot dip galvanized coating is formed. When steel is brought into contact with molten zinc, a series of iron/zinc (Fe / Zn) alloys are produced which metallurgically bond the coating to the steel substrate. In the event that surface contaminants such as mill scale are present, the iron will not come into contact with the molten zinc and hence, unlike other coatings, an uncoated surface will be clearly visible to the naked eye. For this reason, it is not possible to overcoat and hide surface contaminants by hot dip galvanizing hence, visual inspection provides reliable information regarding the quality standard of the applied coating. As a result of this characteristic, hot dip galvanizing is described as a honest coating.

Most protective systems rely on mechanical properties in the coating material to provide good adhesion. In contrast, the hot dip galvanizing process provides a metallurgical bond between the coating and the underlying steel by way of the Fe / Zn alloys which are formed at the interface between the coating and the underlying steel.

These Fe / Zn alloys are harder than the underlying steel and not only do they provide good resistance to abrasion but they also possess superior corrosion resistant properties to those of pure zinc in most environments.

No doubt, these technical facts make favourable reading when considering the merits of a metallurgically bonded hot dip galvanized coating, but, as with everything else which is governed by the laws of nature, there has to be a downside, as indeed there is.

Clearly, the Fe / Zn alloys within a hot dip galvanized coating provide excellent adhesion as well as enhanced resistance to corrosion. On the other hand, if alloy layer growth during hot dip galvanizing is excessive, thick coatings are developed with undesirably brittle tendencies while the surface appearance of the coating is invariably dull grey interspersed at times with dark grey patches. The two elements in steel that are mainly responsible for this phenomenon are silicon and phosphorus while a combination of these two elements at relatively low individual reactive levels can cause excessive alloy layer growth resulting in undesirably thick and brittle coatings.

At a phosphorus content in steel above 0.03%, the reaction between molten zinc and steel is severe while at 0.05%, the coating produced is not only excessively thick but the metallurgical structure is such that adequate adhesion to the substrate is non-existent. This unacceptable situation is at times encountered when so-called commercial grade steel, which is a polite way of describing substandard material, is required to be hot dip galvanized. The quantity of commercial grade steel purchased by fabricators is substantial while the impact that this can have on the quality of the hot dip galvanized coating subsequently to be applied, is invariably ignored.

The influence of silicon is somewhat different from that of phosphorus in that a reactive peak is reached at the relatively low silicon level of 0.08% where after it declines only to significantly increase again at about 0.3%. This phenomenon is generally referred to as the Sandelin Curve after the Swedish scientist who undertook research into the metallurgical reactions between molten zinc and carbon steels.

Silicon or alternatively aluminium is required in steel manufacturing for deoxidising purposes. In the case of the so-called aluminium killed steels, the silicon content is normally well below the first reactive peak of 0.08% whereas the silicon content of silicon killed steels can range from a moderately reactive level of about 0.12% up to an extremely aggressive 0.4% and more.

If the galvanizer is not appraised of the chemical properties of steel to be processed and hence the ultimate thickness of the coating that will be

formed, costing and subsequent viable price setting can be a somewhat speculative exercise. To illustrate, if the mean minimum coating thickness required in terms of the specification is 85µm and the galvanizer is required to process reactive steel, the actual thickness of the coating can be well in excess of 200µm. What this means in financial terms is that the galvanizers' main raw material cost is increased from what is required by some 250%.

It must be said that for corrosive applications, the moderately reactive silicon killed steels have the desirable benefit of ensuring that thicker heavy duty galvanized coatings are developed.

There are effective controls and precautions that the galvanizer can implement in order to limit excessive alloy layer growth provided that he is aware that there is a potential problem. If on the other hand such measures are taken and less reactive steel is unwittingly processed, coating thicknesses below the specified minimum can be the unacceptable result.

What then can be done to solve this somewhat complex problem? No doubt there is a distinct need for education and better communication between the steel merchants, fabricators and the galvanizers. The steel producers have cooperated fully in the past when notified that hot dip galvanizing is a requirement but their assistance is only practical where relatively large volumes of steel are procured for specific contracts.

Perhaps what is needed is for the Hot Dip Galvanizers Association to embark on an education and awareness campaign directed at both fabricators and steel merchants. Fabricators should be encouraged as a matter of routine to inform their steel supplier that subsequent hot dip galvanizing is required, while at the same time requesting a copy of a chemical analysis certificate, which can be forwarded to the galvanizer. Both fabricators and steel merchants should be made fully aware of the technical reasons for these requirements.

Personality Profile

Dr. Roderick G.D. Rankine

(Pr. Eng)

Roderick Rankine is an expert in construction materials and is currently employed by the Cement and Concrete Institute as a professional engineer and concrete technologist. His current title is Education and Training Manager but he also undertakes technical investigations of concrete related problems. In the late 1980's, he undertook a technical investigation on behalf of Middleberg Steel and Alloys – now Columbus to define appropriate properties for corrosion resisting steels such as 3CR12 to reinforce concrete. In the 1990's, he worked for the company R.J. Southey aboard the oilrig Actinia during the final stage of the Mosgas Project before starting Rankine Engineering and later joining Wits University as a lecturer. During this period, he explored several methods of combating corrosion in various environments and has become a strong advocate of hot dip galvanizing.

His extensive experience in the field of corrosion science has lead to numerous discussions and co-operation with the Hot Dip Galvanizers Association. His belief in the corrosion protective properties of hot dip galvanizing was born out by the fact that he made extensive use of the product during the construction of his own private home (see the "Croft Loft" on page 8 in the awards entry section).

He is currently an honorary lecturer at Wits University and author of more than 40 papers published in accredited journals, international conference proceedings and books.

"I am so committed to the concept of Hot Dip Galvanizing as a life cycle cost reducer that I hot dip galvanize all sorts of things, including parts I make for my Land Rover and my Yacht. When I needed a wheelbarrow, I specially drove to the factory to buy an unpainted one so that I could have it Hot Dip Galvanized. It can now stand outside in the rain for longer than I could hope to live and unless it gets stolen, I will never need to buy another one again. Now if that's not commitment, what is?"

Another view of the "Croft Loft" extension.

Guest Writer

Bob Andrew, our guest writer, is a consulting value engineer and Honorary Life Member of this Association.

Project management *IS* knowledge management

The exciting economic and developmental opportunities, brought about by globalization and driven by new technology, have provided an enormous thrust to the discipline of project management. Wherever one looks these days, there are projects, big and small and in many different areas and countries, being planned or executed. The job of a project manager has become a very sought after career.

Apart from all the huge construction projects, where adherence to sound project management principles is essential, a culture of project management is also growing in all walks of life. In his latest book, Re-Imagine, Tom Peters has suggested that all work will become project work and there will be no role for people performing de facto chores, there will be not be any room for 'cubicle slaves', as he calls them. We live in a world where there has to be action and delivery and the methodology of project management is well suited for this.

Project management is knowledge management in practice. The principles and spirit of knowledge management, like knowledge sharing and creation, action, collaborative learning, and achievement of an objective, are deeply embodied in the project management process. It is, however, a disappointment that, knowledge management is not often included in the curricula of most project management courses.

In the project management process, each member of the project team is responsible for acquiring as much knowledge as possible on their own and for sharing it with the other members of the team in terms of their specific disciplines or roles. Appreciation of the knowledge they have as individuals, and recognising what knowledge they might not have, is vitally important for the successful execution of the project. It is vitally important that the team has a clear understanding of the role of knowledge and its flow in the context of the project objectives. In essence, the knowledge management objectives in a project are to turn the knowledge possessed by the team into value for the benefit of the project and to locate, acquire or create the required specific knowledge to properly plan, design, execute and manage the project.

Coherence, the alignment of context, viewpoint and purpose, is what holds the project together. It is the glue that binds the various disciplines and roles enabling the project team to act as one. It includes a broad range of processes. It begins with a shared vision, a shared set of values and a shared understanding of the scope and objectives of the project. It then expands to include the various internal and external relationships and linkages and uses a shared understanding of the project management process to achieve the project objectives. A project team is no different from a knowledge management 'community of practice'.

A project team is a 'whole' that cannot be divided into independent parts. Its defining properties derive from the interactions of its members, not individual actions taken separately. The performance of the project team depends on how the members interact, not on how they act individually. Focusing on improving the performance of individuals in their specific disciplines may improve the performance of the discipline but seldom improves the performance of the team. Having a culture of shared knowledge and learning enables the focus for improvement to be placed on the team and not only the individual members' performance.

Effective project management also means having a good definition of the project deliverable-knowing what has to be done. Many surveys have shown that the prime cause of unsuccessful projects is that the project scope was poorly defined. In too many cases, the project manager or team decide for themselves what the mission of the project is without determining whether this is also what the client or other stakeholders see as the actual objectives of the project. Again, the knowledge management principles of thorough information sharing and constant communication will greatly enhance project definition.

There is no doubt that the application of knowledge management will enhance project management. But, it is also true that the management and control functions of project management that focus on adherence to specified performance criteria and constraints, quality assurance, cost estimates and budgets and time for completion, can greatly enhance the practice of knowledge management. In my experience, in too many cases, the scope and objectives of knowledge management programmes are poorly defined, estimated costs and time for implementation are inaccurate or unrealistic and performance criteria are non existent. As is so necessary today, management functions that were previously independently applied, need to be integrated. This is definitely the case with knowledge management and project management.

Zinc Energy Storage Technology Consortium

Noranda, Peñoles, TeckCominco and Umicore and three manufacturers of energy storage systems based on zinc (Electric Fuel, Evionyx, Power Zinc) have formed the "Zinc Energy Storage Technology" (ZEST) Consortium. The Consortium will advance zinc-air technology and infrastructure through collaborative research and promotional programs. Initially, the Consortium will focus on zinc-air batteries, although other zinc-based systems may be studied in the future.

Currently zinc based batteries including zinc alkaline and zinc-carbon consume around 150 000 tonnes of zinc. Due to advantages such as energy, recycling and safety, it is believed there is a significant market potential for zinc-air systems in several applications, including electric vehicles and stationary batteries, etc..

China could serve as a show case for zinc-air technology. The 2008 Beijing Olympics will require between 3 000 and 8 000 buses. The 2010 Shanghai World Expo will require 3 000 buses per year between 2007 and 2010. The Chinese Government has indicated that it wants to optimize the use of "clean buses". Currently a pilot bus utilizing a zinc-air battery is being developed by a subsidiary of Volkswagen AG.

In addition, China's 10th five-year plan obliges cities with more than 5 million inhabitants and a bus fleet of about 5 000 buses, to have 80% of their buses run on clean energy in the future. A zinc-air battery for a bus contains between 400 and 600kg of zinc. Globally, production reaches about 180 000 buses per year.

Also, the Chinese Government has banned the 2 stroke/2 wheel bicycles. In China, there are currently about 470 million 2 wheel bicycles. Battery-powered 2 wheel bicycles typically contain between 2 and 3kg of zinc. For the larger motorcycles around 10kg of zinc are needed.

A "ZEST" website is currently being developed and a technical workshop will be held later this year. An article on zinc-air batteries has recently appeared in "Batteries & Energy Storage Technology".

This contribution was made possible by the International Zinc Association (IZA)

BROADEN THE TECHNICAL KNOWLEDGE OF YOUR STAFF & CUSTOMERS

Should you wish to broaden the technical knowledge of your staff in terms of effective corrosion protection, the Association would gladly arrange a plant tour followed by a presentation at one of our galvanizing member's plants.

Kindly complete the following and fax your reply to us on (011) 454-6304 at your earliest convenience:

Plant Tour	± 1 Hour	
Office Presentation:	± 1.5 Hours	
Convenient Date/s:		
Time/s:		
Approximate number of attendees:		
Company Name:		
Name of your contact responsible for the arrangement:		
Contact Telephone No.		

The next Coating Inspector's Course is due to be run on the 19th & 20th September 2005. Still a few seats available so book now.

These are just two of the many services the Association offers! Visit our Website or contact us for more information.

Plant tour visitors showing interest in the tube galvanizing process.

Member's list with activity classification

GALVANIZING MEMBERS									
REGION	COMPANY	Membership Category	General Galvanizer	Centrifuge (Spin) Galvanizer	Continuous Sheet Galvanizer	Continuous Wire Galvanizer	Tube Galvanizer	In-Line Galvanizer	Duplex Applicator
GAUTENG	ABB South Africa (Pty) Ltd	GM	●						
	Armco Galvanizers – Dunswart	GM	●	●					
	Armco Galvanizers – Isando	GM	●						
	Barloworld Galvanizers (Pty) Ltd	GM	●				●		
	Barloworld Robor Tube	AM					●	●	
	Cape Gate (Pty) Ltd	GM				●			
	Chrystal Galvanizing	GM	●						
	DB Thermal SA (Pty) Ltd	GM						●	
	Galvadip (Pty) Ltd	GM	●						
	GEA Air Cooled Systems	GM						●	
	Lianru Galvanisers cc	GM	●						
	Mittal Steel	GM			●				
	Pro-Tech Galvanizers (Pty) Ltd	GM	●	●					
	Supergalv	GM	●						
NORTH WEST PROVINCE	Andrag Agrico	GM	●						
WESTERN CAPE	Advanced Galvanising Corporation (Pty) Ltd	GM	●						
	Cape Galvanising (Pty) Ltd	GM	●						●
	Galvatech (Pty) Ltd	GM	●						●
	Helderberg Galvanizing cc	GM	●						
	South Cape Galvanizers (Pty) Ltd	GM	●						
	Zincgrip Galvanizers and Coatings	GM	●						
EASTERN CAPE	Galvanising Techniques cc	GM	●						
	Galvaspin (Pty) Ltd	GM	●	●					
	Morhot (Pty) Ltd	GM	●						
KWAZULU NATAL	A & A Galvanising cc	GM	●	●					
	Bay Galvanisers (Pty) Ltd – Richards Bay	GM	●						●
	Phoenix Galvanizing (Pty) Ltd	GM	●	●					
	Skema Holdings (Pty) Ltd	GM						●	
	Voigt & Willecke (Pty) Ltd	GM	●						
MPUMALANGA	Chevron Engineering (Pty) Ltd	GM	●						
ZIMBABWE	Tube & Pipe Industries (Pvt) Ltd	IGM					●		

NON-GALVANIZING MEMBERS

REGION	COMPANY	Membership Category	Zinc Supplier	Zinc Ash and Dross Recover	Galvanizing Plant Services	Final Product Stockist	Steel Supplier	Metal Spray Equipment Supplier	Other
GAUTENG	Advanced Roof Technologies	AfM							6
	Barloworld Robor Pipe Systems	AfM				●			
	Butterworth Metal Industries	AMG							7
	Chemplus	AfM			●				
	Corrosion & Technology Consultants	AfM							1
	CWI (Pty) Ltd	AfM							8
	Duplex Coatings cc	AfM							3
	Eskom	AfM			●				
	Fairmile Fencing SA (Pty) Ltd	AfM							5
	Harrismith Galvanizers & Steel Profiles	AMG							7
	Hi-Tech Elements	AfM			●				
	Metsep (Pty) Ltd	AMS			●				
	MR Zinc	AMS	●	●					
	O-line Support Systems (Pty) Ltd	AfM				●			5 & 3A
	Orlik Speciality Chemicals	AMS			●				
	Randyork Castings	AfM							5
	Surface Treatment Technologies (Pty) Ltd	AMS			●				
	Strutfast	AfM							5
	Trucking & Engineering	AfM							4
	Weartech (Pty) Ltd	AfM						●	
	Zinchem (Pty) Ltd	AMS	●	●					
	Zinc Corporation of SA	CM	●						
MPUMALANGA	Highveld Steel and Vanadium	CM					●		

MEMBERSHIP CATEGORY ABBREVIATIONS

(CM) Corporate Member
(IGM) International Galvanizing Member
(GM) Galvanizing Member - General
Galvanizing Member - In-line
Galvanizing Member - General and In-line
Galvanizing Member - Continuous
(AMG) Associate Member - Galvanizer
(AMS) Associate Member - Support
(AfM) Affiliate Member - Company
Affiliate Member - Professional
Affiliate Member - Coating Inspector

FOR FURTHER DETAILS CONTACT THE HDGASA

Other:

1 = Corrosion Consultants and Project Managers
2 = Coating Inspection Services
3 = Duplex Applicator
3A = Powder Coating Duplex Applicator
4 = Specialist Pipe Manufacturer
5 = Users
6 = Roofing
7 = Developing Member – Galvanizer
8 = Continuous Wire Galvanizer

Voigt & Willecke become a Black Economic Empowerment Company

Voigt and Willecke are pleased to announce that they are now a Black Economic Empowerment Company. The new shareholders, who they welcome on board are Mr J. Reddy and Mrs K. Reddy.

A working relationship will be maintained with the previous German shareholders.

ENVIRONMENTAL AND MATERIALS CONTROL FOR HOT DIP GALVANIZING PLANTS

A draft document, with the subject title, has been compiled and is open for review and comment at the offices of the Association. This document has been produced by an Association sub-committee and is part of our proactive co-operation with the Department of Environmental Affairs.

The Association would like to acknowledge the advertisers and thank them for their support

Case History
No. 04/2005

Hot dip galvanized steel reinforcement in concrete
"The truth after 40 years"

The Application

Hot dip galvanized reinforcement for additional corrosion protection for reinforced concrete structures. The use of hot dip galvanized reinforcement is not a replacement for good quality concrete, but as an added corrosion protection, which is estimated to extend the service life of concrete structures by between 3 and 4 times. The quality of concrete is subject to many variables, not least being practical site conditions, installation and placement supervision, compaction of the concrete, cement:water ratio, curing, depth of concrete cover over the reinforcement and ultimately the environmental conditions.

The site of the 40-year-old pedestrian bridge (No B776), which was demolished (April 2005). It was established that hot dip galvanized reinforcement was used in the approach stairway, which was on the sea facing side, indicated on the left of the photograph, with the sea some 50m further left.

Environmental Conditions

The environmental conditions are described as severe marine, (class C5M in terms of ISO 9223), subjected to sea spray, chloride attack, carbonation, and the quality of the concrete, i.e. durability (oxygen permeability and sorptivity).

The Site

This case study is the result of a detailed investigation into a demolished pedestrian bridge, that was situated along the foreshore of Algoa bay.

Sample concrete cores were extracted from the sea facing side, top slab and landside of the structure. These samples were sent to an independent concrete diagnostic & durability laboratory with instructions to establish the ingress of chlorides, carbonation and quality of the concrete. The depth of reinforcement cover was confirmed as being 45 to 60mm and a sample of hot dip galvanized bar was retrieved for examination.

Our Findings

Chloride concentrations (% as mass of cement) at a depth of 45 to 60mm ranged between 0.15 & 0.65 on the side

2 Core Samples
Taken on the side facing inland. Carbonation penetration 18 to 22 mm, chloride level at 45 to 60 mm 0.15% to 0.65% as mass of cement.

2 Core Samples
Taken on the sea facing side. Carbonation penetration 5 to 23 mm, chloride levels at 45 to 60 mm 0.27% to 1.26% as mass of cement.

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facing inland, and 0.27 & 1.26 on the sea facing side. At a depth of 30 to 45mm the chloride concentrations ranged between 0.19 and 2.6. Chloride levels at a depth of 15 to 30mm rise to between 0.49 to 8.8 as a % of cement mass. Accepting that the typical limit is 0.1% chloride for uncoated reinforcement, it should be totally unacceptable to use plain reinforcing without additional corrosion protection in this environment.

Carbonation was found to be more severe on the landside of the structure, with penetration depths of 18 to 22mm.

Concrete durability index testing results of oxygen permeability was as follows:- 1 sample "very good", 1 sample "good", 4 were "poor" and 1 "very poor". Sorptivity of 2 samples were excellent, 2 good and 2 were poor.

Notwithstanding the findings at the 45 to 60mm depth of cover, numerous reinforcing bars were found at depths of 15 to 45mm. Even at the reduced concrete cover depths and increased chloride levels, the hot dip galvanized coating continued to protect the reinforcing bars. In certain isolated cases where the corrosive conditions had penetrated to the steel, due to very limited cover, the zinc had been sacrificed and some attack was evident of the carbon steel.

Condition of the reinforcement

Reinforcement was taken from the structure for micrograph analysis to establish the amount of zinc coating that was retained after 40 years in service. The depth of cover of the two samples was selected at 45mm and 60mm respectively.

The outer appearance of the bar section demonstrated a dull grey colour with no significant zinc layer degradation in terms of white rust formation.

A transverse cross section through the bar revealed a 'normal' galvanized zinc skin with the constituent sub-layers clearly delineated (*Figures 1 and 2*). The hot dip galvanized skin thickness was between 240-260µm.

Isolated red rust was found, usually associated with minimum concrete cover and/or mechanical damage to the concrete cover.

Conclusion

Examination of the hot dip galvanized reinforcing, after 40-years in service, revealed conclusive evidence that the zinc coating provided excellent corrosion protection to the steel.

While other forms of reinforcement protection are available, it can be shown that hot dip galvanizing of reinforcing is a preventative process that must be applied as part of the construction process. It is a system of "prevention is far better than cure" The economics are best described in the following extract from a recent publication "Corrosion of Steel in Concrete" by Bertolini, Elsener, Pedeferri and Polder.

"The cost of adequate prevention carried out during the stages of design and execution are minimal compared to the savings they make possible during the service life and even more so, compared to the cost of rehabilitation, which might be required at later dates. The so-called De Sitter's "law of five" can be stated as follows: one dollar (R6.00) *spent in getting the structure designed and built correctly is as effective as spending* $5 (R30.00) *when the structure has been constructed but corrosion has yet to start,* $25 (R150.00) *when corrosion has started at some points,* $125 (R750) *when corrosion has become widespread".*

The condition of exposed hot dip galvanized reinforcement found during the demolition of the 40 year old bridge. With isolated exceptions, the hot dip galvanized reinforcing shown, in this photograph, is typical of 98% of that inspected.

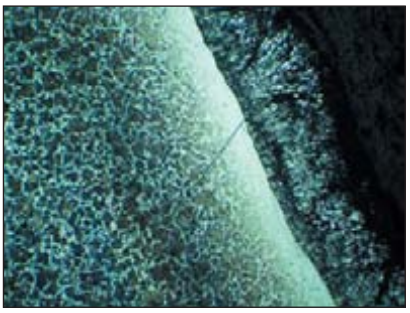

Figure 1. Hot dip galvanized layer (240 - 260µm) on the reinforcement bar (100x).

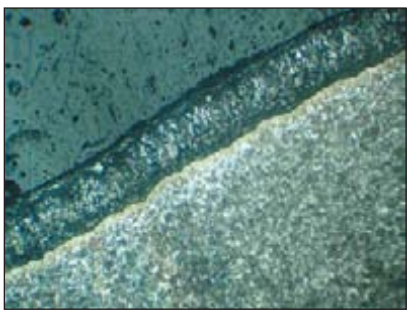

Figure 2. Hot dip galvanized layer on the reinforcement bar 45 to 50mm cover (100x).

Test samples were extracted from the demolished bridge.

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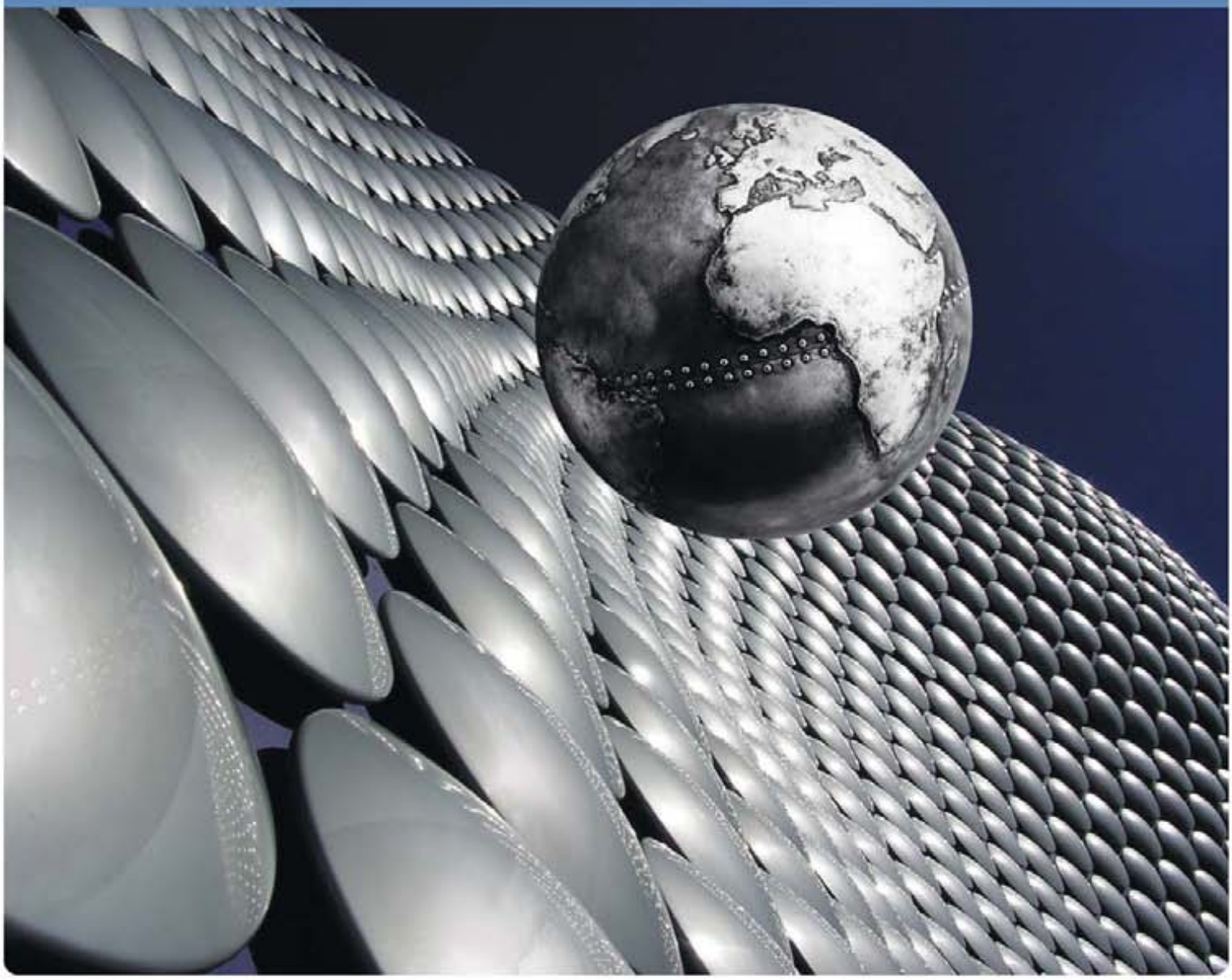

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