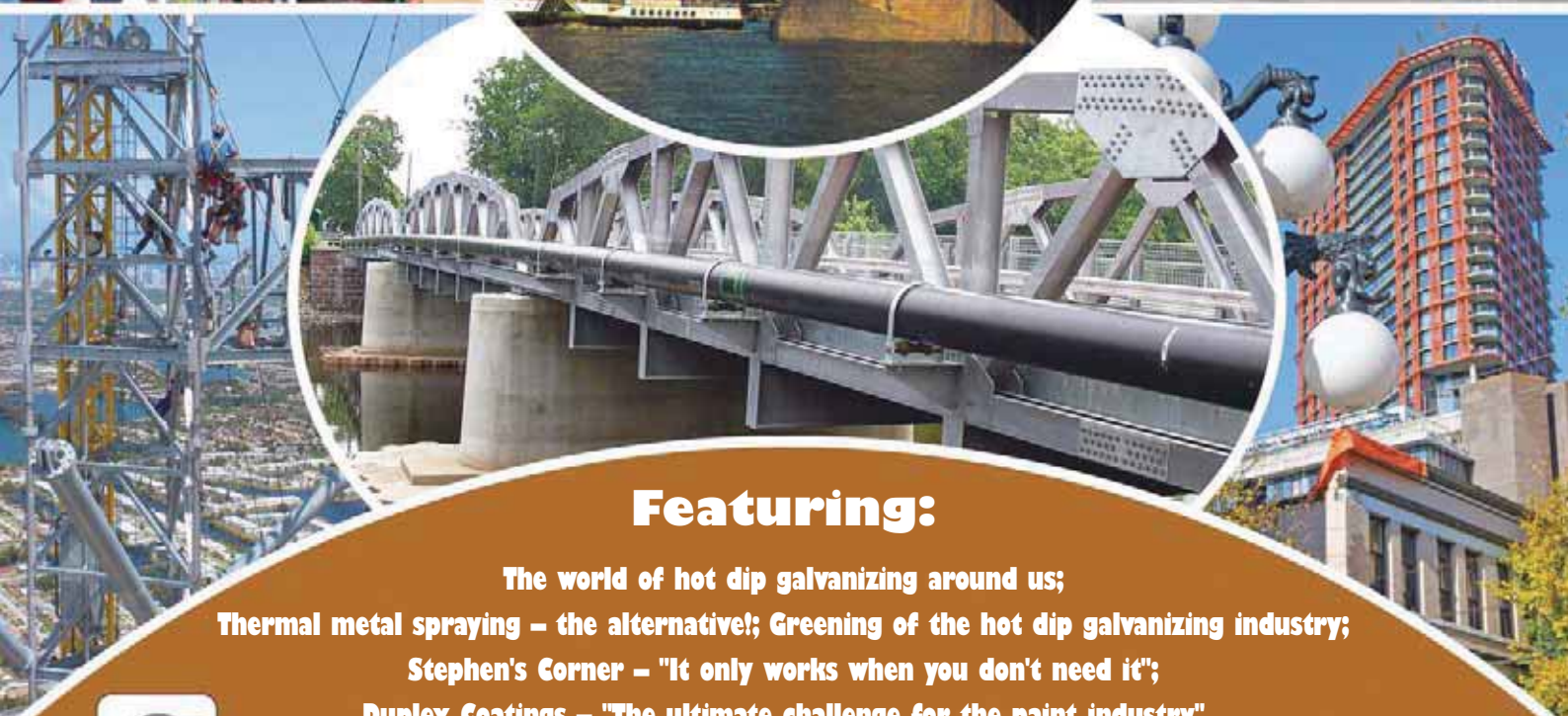
2010 Volume 7 Issue 4

HOT DIP GALVANIZING TODAY

HOT DIP GALVANIZERS ASSOCIATION Southern Africa

45



Featuring:

The world of hot dip galvanizing around us;
Thermal metal spraying – the alternative!; Greening of the hot dip galvanizing industry;
Stephen's Corner – "It only works when you don't need it";
Duplex Coatings – "The ultimate challenge for the paint industry"

Other regulars include – Bob's Banter; "On the Couch"
and Education and Training: New galvanizing inspector courses

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

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Front Cover: *A kaleidoscope of photos showing some exciting international hot dip galvanized and duplex coating projects (courtesy of the AGA & GAA) as well as The Tower Bridge in London where significant metal parts were thermal metal sprayed and painted.*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment

As we move towards the end of 2010, a brief review of the past year would seem to be in order.

In looking back, 2010 has been a year filled with a great deal, and a large variety of different activities, but alas also include concerns for the economy.

In reviewing the year, my immediate impression relates to imports that compete with home grown products. This is best illustrated by what is being experienced in the local power transmission line manufacturers. Imported product is landing in South Africa at values similar to the local raw material costs. Taken to its logical long term conclusion, such low cost imports can close down our local manufacturing facilities and cause the country to become dependent on foreign imports.

Is this strategically acceptable?

Association staff continue to be actively engaged in formal technical presentations, road shows, technical seminars, numerous site visits, as well as reporting on issues of coating quality, corrosion control methods, including and beyond the use of hot dip galvanizing and Duplex coatings. Part of such activities, we have been heavily involved in training and specifically the continuation of our Inspectors Courses. As previously reported, from 2011 we will present the course over a three day period and include far more practical activities. A visit to our website will allow interested parties to download the application form should they wish to attend one of these informative and educational three day courses.

To all our supporters, readers of our journal, consulting engineers, fabricators, project developers and Association members, we wish you well for the coming festive season and a successful 2011.

Bob Wilmot

Note from the Editor

Our main features for this issue include, "**The world of hot dip galvanizing around us**" where we feature a number of interesting projects from America (courtesy of AGA) and Australia (courtesy of GAA); "**The alternative metallic coating corrosion control system – thermal metal spraying**", when coating repairs are necessary or articles are too large or technically unsuitable for hot dip galvanizing; and "**Greening of the hot dip galvanizing industry**", here two new interesting projects from our industry have been submitted.

We understand that the 2009 version of the ISO 1461 has been accepted by the SABS and its National Committee and will shortly be launched as a SANS 121 Standard and while the final launch date of is unclear, there are some significant changes to the clause on "Appearance" and "Essential information for provision by the purchaser" (the latter will be discussed in the next magazine). I highlight two statements from the appearance clause which I believe are extremely important.

"At acceptance inspection, the significant surface/s of all the hot dip galvanized article/s, when first examined by normal corrected vision from a distance of not less than 1m, shall be free from nodules, blisters, roughness and sharp points and uncoated areas."

"The primary purpose of the galvanized coating is to protect the underlying steelwork against corrosion. Considerations related to aesthetics or decorative features should be secondary. Where these secondary features are also of importance (#1 - as in architectural hdg and/or when the article is to be duplex coated), it is highly recommended that the galvanizer and customer agree upon the standard of finish that is achievable on the steelwork (in total or in part), given the range of materials used to form the article."

Where #1 is required it is therefore highly recommended that the selected galvanizer be involved in the project team from the outset of the project!

Galvpatch an equivalent and appropriate zinc rich epoxy repair material in competition to the original product, **Zincfix** has just recently been launched. The Association is now keeping stock of both products.

Prof. Stephen Yeomans in his "Corner" – "**It only works when you don't need it!**" – includes the third part in the series on hot dip galvanized rebar.

The **Duplex** feature includes an article by Pieter Uys of Strutfast, "**The Ultimate Challenge for the Paint Industry!**"

"**On the couch**" features architect Charles Taylor who over the years has developed a passion for using hot dip galvanizing on many of his projects and just lately his own new home on the hills over looking Ballito Bay. Charles' projects including his exciting new home will be presented in a subsequent magazine.

Education and Training, includes our new three day certificated coating inspectors course which will be launched in 2011.

Other regular articles include, **Bob's Banter** where Bob Andrew chats about "**Adding value**".

We take this opportunity to thank readers, advertisers and members for their ongoing support throughout the year in spite of difficult times and wish them a happy, safe and prosperous festive season and 2011. Enjoy the magazinc!.

Terry Smith

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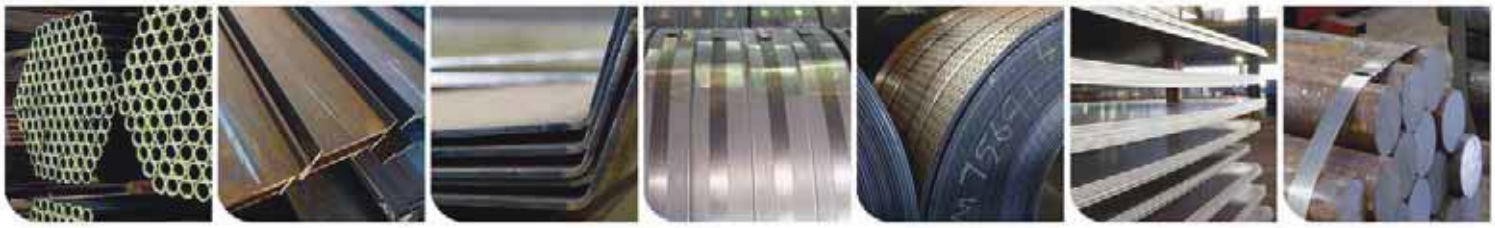

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The Asia Pacific General Galvanizing Association (APGGA)

Singapore's "Southern Ridge" Eco-walkway

Introduction

Whilst Singapore is considered a highly urbanised city-state, it retains some surprisingly unique and beautiful parkland areas. Enabling the public to better access and appreciate these parklands has been a priority of Singapore's Urban Development Authority. The Southern Ridge project, completed in 2008, has been a case in point, involving amongst other features for this parkland area two initiatives of special note, the "Forest Walk" and the "Henderson Waves". These form part of an elevated walkway construction at treetop level, providing breathtaking views of the landscape whilst importantly, in keeping with the ideal of minimal disturbance to the surrounding area, leaving as small a "footprint" as possible on the ground below.

The Forest Walk at an elevation varying from 7 to 20 metres above the ground, and spanning approximately 1.5 kilometres, is an all-steel construction which makes extensive use of galvanizing. Galvanized components include the slender column supports, structural crossbracing, security railings and steel gratings for the walkway floor. In addition to corrosion protection, a further consideration favouring the choice of galvanizing was the fact that it is a factory applied process, thereby avoiding the need for an intensive "on-site" steel coating operation which might potentially impact on the critical requirement to preserve the natural surroundings in pristine condition.

The Henderson Waves form a bridge of unique design which spans the busy Henderson Road passing through the parkland area. It is the highest pedestrian bridge in Singapore at 36 metres elevation. Its distinctive wavelike structure comes from seven undulating curved steel "ribs" that alternately go above and below the bridge deck. Where these ribs rise over the deck, they form alcoves that provide shelter to visitors. The steel ribs are galvanized and paint top coated for aesthetic purposes.

The Forest Walk.

The Henderson Waves.

The Henderson Waves project received the Singapore Structural Steel Society Award in 2009 for innovative use of steel, whilst the Forest Walk project received an international architectural award given by the Chicago Athenaeum: Museum of Architecture and Design.

Acknowledgement:
Galvanizers Association of Australia – www.gaa.com.au

Bridges in Asia – Taiwan

Recent vigorous economic growth in South East Asia has redistributed population and expanded industry and infrastructure building.

Development of rural and remote regions required innovative engineering solutions to gain right of way to new land for extractive purposes, industry, urban development and the critical arteries of commerce – roads.

In countries where, historically, seaports and rivers were the main outlets, roads and bridges emerged to provide heavy load capability and more reliable and productive transport.

In this respect steel bridges were found well suited to the pace of development and challenging terrain. Offsite completion, orthodox freight to site and relatively simple erection were invaluable aids to the rapid expansion of the time.

The use of steel in bridge construction is not new, and knowledge of the manufacture and behaviour of this material is well understood where advancing design use of steel has resulted in economical and aesthetically pleasing bridge structures. Steel offers particular advantages in that it can be shop fabricated, under controlled conditions, to almost any desired cross sectional geometry to meet the specific strength requirement at each site, often at completely undeveloped locations.

However corrosion prevention is one essential factor in the economic utilisation of steel where provision of the appropriate protective coating can influence initial and whole of life cost, eliminate maintenance and lost service time, and defer the replacement date of structures.

A wide variety of products have been used for this purpose, however, many bridges require permanent maintenance teams to sustain adequate steel protection.

In most environments, after fabrication galvanizing provides very suitable corrosion protection for steel and has a range of coating characteristics which make it unique. These include an alloy hardness greater than mild steel, a self-inspecting process discipline and predictable life directly proportional to its heavy coating thickness. These result in a surface alloy with competitive cost, resistance to severe impact, extended service life and in turn reliability for use in engineering calculations.

Taiwan

The Ma Tsao Bridge in Mount Yang Ming, North Taiwan, the earliest bridge to utilise after-fabrication hot dip galvanized steel, was opened in 1992. From then on, approximately 30 000 tonnes of steel and around 30 - 40 bridges have been hot dip galvanized. The most representative of these bridges are the Chung Cheng Overpass and the Linkou Bridge. There are now approximately 25 000 tonnes of bridges

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The Linkou Bridge, Taipei

Chung Cheng Overpass Bridge, Taipei.

Car park in Makati City, Manila, Philippines.

under construction which are the result of work by the galvanizing industry, with government and academia, in presenting proof of service of the hot dip galvanizing process, where security, low cost and reliability were crucial factors.

Taipei – Linkou Bridge

The Linkou Bridge is an 8-lane overpass bridge, 22.6 metres in width and 1 065 metres in length, located in a non-sheltered environment adjacent to the seafront on the northeast coast of Taiwan. This girder type bridge utilised 7 300 tonnes of galvanized 2 metre girders as well as 3 030 tonnes of galvanized steel reinforcement to provide long-term corrosion protection in the salt-laden atmosphere of the Taiwan Strait.

Authority: *Taiwan Highway Bureau*

Taipei – Chung Cheng Overpass Bridge

The Chung Cheng Overpass Bridge, opened in 1996, has 6 lanes, is 24.9 metres wide, 1 672 metres in length and utilises 7 000 tonnes of hot dip galvanized steel girders. Heavy vehicular usage across the bridge and roads beneath, and the confined nature of the location with buildings in such close proximity, would make any bridge maintenance a major logistical problem.

Authority: *Taiwan Provincial Housing and Urban Department Bureau*

Designer: *China Engineering Consulting Inc*

Construction: *RET-SER Engineering Agency and Evergreen Heavy Industrial Corp.*

Acknowledgement:
Galvanizing Association of Taiwan
www.galtw.org.tw

The architectural integration of car parks – Ayala Avenue, Makati City, Manila, Philippines

This car park structure is situated in Makati, the main commercial centre of metropolitan Manila.

The development was in response to the urgent need for additional car parking in Makati due to the rapid increase of commercial offices and shopping malls in the district.

Accompanying shopping and residential apartment complexes created a modern and prestigious neighbourhood into which this highly visible car park structure has been tastefully located.

The need to build within a minimum site area in an already well developed location, while allowing fast track schedules, led to design of a bolted steel structure capable of minimum erection time.

This car park seems to epitomise the design achievements of traffic interchanges in Asia, where elevated roads mounted on galvanized steel columns play a major role in easing traffic congestion.

In particular the car park's 7 metre beam lengths and 3.5 metre vertical column height, create extra headroom, light and ventilation and a valuable 5 000 square metres of floor space in this heavily built up area.

This design also offers the capacity to add to or dismantle and relocate the structure.

For this purpose galvanized steel offered unique suitability both from the standpoints of long service life and its metallic alloy abrasion resistance during steel handling.

In summary, steel design provides not only efficiency in maximising space, light and security but offers advantages in time and cost during construction and future planning.

The final architectural appearance achieves fine harmony with its community surroundings.

Location: 6748 *Ayala Avenue, Makati City*

Capacity: 434 *cars*

Supplier/ Contractor: JFE *Civil Engineering & Corporation* (*Japan*) / RIOFIL *Construction Corporation* (*Philippines*)

Construction: 1998

Acknowledgement:
Association of Galvanizers Indonesia
www.agindo.org/index.html
Galvanizing Association of Malaysia

Bridges in Asia – Singapore

Bukit Timah Pedestrian Road Bridge

This bridge is estimated at 56 metres in length and 2.2 metres wide and is composed of 33 tonnes of steel. After-

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Bukit Timah Pedestrian Road Bridge

Car park of the Noichi Zoological Gardens, Noichi, Japan.

Fisherman's Wharf - EGG Kushiro City, Hokkaido, Japan.

fabrication galvanized steel protection was chosen to provide a superior finish and to prolong the life span of the steel. Ability to withstand the hard wear of constant pedestrian traffic was important and a duplex colour topcoat was applied over the galvanizing to provide an aesthetically pleasing architectural finish.

Innovative case studies using hot dip galvanizing – Japan

Car park of the Noichi Zoological Gardens

The big roof of the Noichi Zoological Gardens car park is equipped with solar panels and is supported by galvanized steel beams.

These solar panels supply about 6% of the total electricity consumption necessary for the gardens and at the same time prevents the elevation in temperature of the parked cars.

Output: 70*k*W

Built: 1994

Site: *Noichi, Kochi Prefecture*

Fisherman's Wharf – EGG *Kushiro City, Hokkaido*

The name "EGG" originates from Ever Green Gardens, as well from its egg-like appearance.

It is part of the Complex of Kushiro Fisherman's Wharf in Kushiro City, Hokkaido.

Although located in the northern part of Japan, it offers a relaxing place with beautiful flowers and green leaves all year round for both visitors and citizens.

Built in 1990, the steel columns and beams were galvanized to give protection from corrosion due to the humid air in the garden room.

Acknowledgement:
Japan Galvanizers Association
www.aen-mekki.or.jp

The HDGASA *wishes to thank* GAA *for arranging this contribution.*

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From the USA...

Deltaport Third Berth Expansion
Delta, British Columbia

With tall rows of gleaming racks spanning far as the eye can see across the Strait of Georgia in Delta, British Columbia, the Deltaport Third Berth Expansion is a response to rapidly increasing industry demand. With projections indicating a doubling container traffic in the next ten years, and a tripling in traffic in the next 25 years, Deltaport is planning for the future by both expanding its container handling capacity and by utilising durable, maintenance-free hot dip galvanized steel for corrosion protection.

Sharing a location with the "Westshore Terminal" coal port, the Third Berth Expansion is subjected to some of the harshest environmental factors possible. Perched in the chilly, saltwater environment of the North Pacific shore, the container racks of the port must withstand the highly corrosive effects of rain, snow, and salty sea air. As the metallurgically bonded zinc coating protects edges and flat surfaces alike with no weak spots, seeping water will have nowhere to take hold – stopping rust and corrosion before it starts.

The durable zinc coating is more difficult to penetrate than the substrate steel itself with zinc-iron alloy layers of up to 250 DPN hardness protecting the steel beneath. Such strength is important for container racks that will continually be exposed to rough handling in day-to-day operations. In addition to protection from abrasion, hot dip galvanizing also provides cathodic protection, which means the zinc will sacrificially corrode to protect the areas around small scratches ionically – preventing rust from spreading like wildfire across a structure.

This outstanding durability will ensure these hot dip galvanized steel structures will last 50+ years with little or no maintenance, a factor critical to the ongoing operation of the facility. No time or money will be wasted with costly, ineffective touch-ups and repairs. Instead, the galvanized racks will stand strong and corrosion free, enhancing the functionality of the facility.

With more than 690 tons of structural steel for container storage, fasteners, and gratings hot dip galvanized, the owners of Deltaport are planning for a long life of durable, maintenance-free corrosion protection that will support the port's expanding operations long into the future.

Deltaport Third Berth Expansion, British Columbia.


"Women of the Future" statue, Quebec.

Galvanizer: *Silver City Galvanizing, Inc.*
Specifier: *Kay-Son Steel*
Engineer: *Vancouver Port Authority*
Engineer: *Brymark Installations*

Women of the Future
Sherbrooke, Quebec

Perched in a peaceful, grassy park, "Women of the Future" reaches heavenward with a graceful, glinting twist of steel ribbons. The piece was commissioned to mark the 30th anniversary of "L'escale de L'estrie," a women's shelter in Sherbrooke founded by Lauretty Demontigny, and represents the first time the city of Sherbrooke accepted a structure gifted to the city. The feminine metal forms depict the spirits of two women, freed from the conditions of abuse and, step by step, finding security, dignity, and independence.

The statue is placed in a position of great prominence in Jacque Cartier Park, the principal park of the city and site of many cultural events and celebrations throughout the year. Both the creator and the city insisted

on galvanizing the sculpture for two different but compatible reasons. First, the city wanted to ensure their acceptance of the structure would not impose an upkeep cost on the taxpayers. Because hot dip galvanized steel requires little or no maintenance for 75+ years in a suburban environment, the taxpayers will not have to fund costly touch ups to maintain the piece's appearance over the years.

Second, the artist wanted assurance his work would not diminish unduly with age. The durability of the zinc coating will protect the piece from the appearance of rust, and perhaps worse, deterioration of the structure itself. The complexity of the design, comprised of flowing, artfully entangled steel strips, could never have been painted properly and would have resulted in rusting at the overlaps almost immediately. The galvanizing process promised full zinc penetration of all complex joints, guaranteeing the lovely ladies will remain unmarred by unsightly rust stains.

The artist also appreciated how the coating will age slowly and naturally in a dignified way, approximating the human condition itself. Despite constant exposure to sunlight, rain, and snow, "Women of the Future" will carry on for many years with continued grace and beauty, unmarred by the ravages of corrosion.

Bergen County Bridge, New Jersey.

Galvanizer: *Corbec Corp.*
Specifier: *City of Sherbooke*
Artists: *Annie Bilodeau; Creations Tetro, Inc.*

Bergen County Bridge
Fairlawn/Patterson, New Jersey

Breaking through a lush grove of trees to connect the cities of Fairlawn and Patterson, New Jersey, the Bergen County bridge is one of several in the state to utilise hot dip galvanized steel for corrosion protection. A natural surface appearance was desired by both communities to help the gently arcing bridge complement and not supersede the surrounding vegetation.

This goal was achieved by incorporating a new truss design to replace the previous view-obscuring plate design, so the public could continue to enjoy the scenic view of the creek flowing through the trees. In keeping with this natural emphasis, the soft, gray appearance of the zinc coating blends seamlessly into the surrounding environment.

Not only will the galvanized coating provide a pleasing aesthetic, it will also keep the appearance of the bridge unmarred by the unsightly effects of rust and corrosion. The barrier and cathodic protection developed during the galvanizing process will keep the bridge both structurally sound and free of dripping or streaking rust stains.

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The large size of the trusses necessitated a progressive dip, where first one end and then the other are dipped into the molten zinc bath to provide full coverage for oversized elements. Special care was taken during the progressive dipping of the truss material to conceal any dip lines for an attractive, uniform zinc coating. All two tons of trusses, floor beams, flooring, diaphragms, supports, rail, and plates were hot dip galvanized, ensuring the bridge will remain an attractive, functional addition to the two communities for generations to come.

Galvanizer: V&S *Columbus Galvanizing* LLC
Specifier: *Bergen County/ Maser Consulting*
Engineer: *Maser Consulting*
Fabricator: US *Bridge*
Additional: *Dopp & Dopp Associates*

El Andaluz commercial offices and residences

Santa Barbara, California

Step into architect Jeff Shelton's El Andaluz courtyard and prepare to be transported to a far away world of colour and whimsy. A bold kaleidoscope of ornately coloured ceramic tile floors, fountains, ledges and stairs are strikingly juxtaposed with the glinting metal of laser-etched hot dip galvanized steel balconies and support structures. The commercial offices of El Andaluz, coupled with residential condominiums, prominently display hot dip galvanized steel elements in Shelton's adaptation of a similar picturesque courtyard six blocks from the Pacific Ocean in Santa Barbara.

With a reputation for favouring galvanized steel elements in his creations, the architect was depending on the zinc patina finish, which develops in the months after galvanizing, to enhance the look of his artistic creation. As the patina develops, the galvanized steel will not only take on a uniform matte gray appearance to complete the architect's vision, but will also ensure long-lasting protection for the project. The galvanized steel was incorporated to assure the structural integrity of the architectural display for decades to come, as it will stand strong and uncompromised by the ravages of corrosion for 75+ years.

El Andaluz commercial offices and residences, California.

In addition to a long life for the structure, another high priority for El Andaluz was a maintenance-free corrosion protection system. Unlike other corrosion protection systems, such as paint, galvanized steel remains maintenance-free for 75+ years. No maintenance means no need for costly, interruptive, and repetitive touch-ups, as well as less impact on the environment – the 100% natural zinc coating will not require any of the volatile and wasteful energy outputs associated with continuous repair.

Handling of the elaborately designed pieces provided a challenging opportunity for the galvanizer to apply his skills. Because of the exposed nature of the galvanized features, special handling was required to ensure the finished product complied with the architect's vision. Large, three-dimensional plate frames had to be specially secured on dedicated racks to guarantee a quality finish. Despite complicated handling and scheduling procedures implemented for this project, the 26 tons of embed angle frames, laser-cut plates, flat bar braces, and threaded studs were completed on time with quick turnaround.

The intricate pieces were then incorporated into the final design of the courtyard. El Andaluz interlaces

Woodwards Building "W" Tower, British Columbia.

the aspects of galvanized steel with a collection of colourful tile artwork and ceramic flower pots for a one-of-a-kind architectural experience that elevates traditional courtyard design to that of artistic masterpiece.

Galvanizer: *Valmont Coatings – Calwest Galvanizing*
Specifier: *Dan Upton*
Architect: *Jeff Shelton*
Engineer: *Leon Olsen*
Fabricator: *Angeles Steel Services*

Woodwards Building "W" Tower
Vancouver, British Columbia

Reaching high into the Vancouver sky, the windowed walls of the Woodwards Building "W" Tower are laced with columns of intricately etched decorative panels depicting tangled branches. These panels take advantage of the increased corrosion protection of a duplex system. For projects that require a particular colour scheme, duplexing is a good way to get the corrosion-resistant protection of galvanizing, while allowing a structure to incorporate any colour desired. Duplex systems combine the superior protection of galvanized steel with the additional benefits of another corrosion protection system such as powder coating or paint to extend the life of the piece even further.

The extended time-to-first maintenance of galvanized steel, combined with the additional durability created when using these two systems in tandem, means the typical repetitive, scheduled maintenance for paint on bare steel will be significantly reduced, and no unsightly paint peeling or rust bleeding will occur.

Instead, the galvanized steel will protect the core of the panels, preventing unsafe deterioration created by corrosion. With this protection, ivy-filled planter boxes on every third floor of the building will be free to grow and mimic the floral patterns on the screens themselves, unperturbed by touch-up crews and high-rise maintenance equipment.

With more than 760 housing units, as well as the David Suzuki foundation and Simon Fraser University Downtown campus, currently occupying the "W" Tower, the building owners can little afford to waste time and money on maintenance. The duplex system will protect the steel panels from the inside out, while allowing the bright colouring consistent with the architect's vision to exist free of corrosion.

Galvanizer: *Silver City Galvanizing, Inc.*
Specifier: *Clearbrook Ironworks*
Architect: *Henriquez Partners*
Engineer: *Glotman Simpson*

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Candelabra Tower, Florida.

First Energy Summit, Ohio.

Candelabra Tower

Miami, Florida

Piercing the cloudy heights of the Miami sky, the Candelabra communications tower is the tallest structure in the city at 1 042 feet. The structured tangle of more than 460 tons of tubular members, solid bar leg structures, fasteners, anchor bolts, and angle bracing was so impressive, it was featured in the October 2009 issue of Modern Steel Construction highlighting the challenging size and design of the project. A structure of this size had to slip-fit and all bolted holes needed to align and be clean and useful at the extreme height the material was to be assembled (more than 1 000 feet).

With the height of Candelabra, corrosion could be structurally devastating – and the highly corrosive saltwater environment of Miami meant every precaution must be taken to protect the steel from the potential threat. For more than a decade, the owner has chosen to hot dip galvanize their radio and communication towers because of the consistently proven durability for this application. Given this experience, the owner felt there was no better way to combat the corrosive sea air and seasonal storms typical to the city than to hot dip galvanize all of the critical structural components.

Galvanized steel is the most effective means of protection against the harsh sun, rain, and salty sea air of Miami. Specifiers in southern Florida now have a structure to inspect and examine in the future when determining what corrosion protection system to utilise, as the Candelabra will stand head and shoulders above the rest, corrosion-free, for generations to come.

Galvanizer:	*V&S Delaware Galvanizing* LLC
Specifier/Fabricator:	*Stainless* LLC
Engineer:	*Tom Hoenninger*

First Energy Summit

Stratton, Ohio

The gypsum pipe conveyor, constructed on the Sammis River site, is a portion of the $1.5 billion project expected to reduce emissions of sulfur dioxide by 95% and nitrogen oxide by at least 64% at First Energy's largest coal-burning electric generating plant. The 2.4 mile long hot dip galvanized conveyor stretching through the countryside is part of a hollow rock waste gypsum disposal facility built on a reclaimed strip mine.

Limestone is used in the scrubbers as a reagent to remove SO2 from the emissions. During the process, the limestone is converted to synthetic gypsum. The synthetic gypsum is dried and then transported to the facility on the enclosed conveyor belt. The "scrubber sludge" gypsum is then used to make wallboard, further reducing waste.

In keeping with these green efforts, utilising a 100% natural, recyclable zinc coating for corrosion protection means no VOC's or wasted energy will be expended on maintenance. hot dip galvanized steel is highly durable, and will remain maintenance free for 75+ years. Even through the structure's constant exposure to sun, rain, and snow.

Photo - Courtesy of Paul Warchol

Morris Arboretum "Out on A Limb" Tree Adventure, Pennsylvania.

The durability of the coating was also necessary because the conveyor was built over steep terrain surrounding the power plant – difficult access for touch-ups and maintenance required by other corrosion protections systems, such as paint. The conveyor also needed a coating that could survive the rough handling conditions of transporting 578 000 tons of limestone annually. Thanks to the dual barrier and cathodic protection of hot dip galvanized steel, small nicks and abrasions will not compromise the stability of the entire structure.

The owners and community desired an attractive appearance for the structure. As much of the conveyor was built on leased property, the owners wanted a clean, consistent look for the machine, which also crosses public roads. The high quality, consistent finish of hot dip galvanizing satisfied this need.

Given the high price tag and the public visibility of this project, the progress of this upgrade will be closely watched. hot dip galvanized steel will keep the conveyor attractive, durable, maintenance-free, and running efficiently for decades to come.

Galvanizer: *Young Galvanizing, Inc.*
Specifier: *First Energy*
Engineer: *Koch GM*
Fabricator: *Classic Conveyer*

Morris Arboretum "Out on A Limb" Tree Adventure
Philadelphia, Pennsylvania

Weaving like a spider web throughout the verdant canopy of the Morris Arboretum, the hot dip galvanized steel walkways of the "Out on a Limb Tree Adventure" provide a pathway to the treetops for nature enthusiasts. Located just outside of Philadelphia, the exhibit was developed to give visitors a bird's eye view of the forest.

Consisting of a 450-foot long canopy walk constructed around a 250 year-old chestnut oak tree, the hot dip galvanized steel structure overlooks the steeply sloped woods of the Wissahickon Valley. In keeping with the bird's eye theme, visitors can walk into a human-sized birds' nest constructed of galvanized steel and interwoven with branches hovering at a daring 80 feet above the forest floor.

The specifiers originally considered painting the project for corrosion protection, but after considering the life cycle cost savings of a maintenance-free hot dip galvanized steel corrosion protection system, the choice was obvious. In the forest environment, galvanized steel has a life expectancy of 75+ years before

continued on page 16...

Calypso Water Park, Ontario.

requiring any type of maintenance, making it ideal for this complicated structure.

The architect, in consideration of the natural environment of the arboretum, wanted to specify a sustainable structure that would add to the greenness of the trees, rather than detract from it. The structure is comprised of lightweight, recyclable galvanized steel and wood, which required less space than concrete foundations, decreasing the risk of damaging the trees and their roots. utilising a galvanized steel frame design also allows the owners to easily modify the structure should something happen to one of the surrounding trees.

With an aggressive schedule for completion, time was of the essence. The quick turnaround of the pieces – some taking less than a day – and cooperation of the designers, fabricators, and galvanizer, helped keep the project on schedule. A total of 155 tons of steel was galvanized, including walkways, framing, handrails, canopy, tube steel supports, tower structures, and even the life size "nest" structure.

Upon completion, the specifiers had no doubt the contrast of the glinting galvanized steel amidst the lush, green forest would attract many visitors curious to see the 92-acre view from the expansive canopy platform. Thanks to the durable, sustainable protection of hot dip galvanized steel, the Tree Adventure will remain an attractive, structurally safe and environmentally friendly web through the canopy.

Galvanizer:	*American Galvanizing Co., Inc.*
Fabricator:	*DDM Steel Company*
Architect/Engineer:	*Metcalfe Architecture and Design*

Calypso Water Park

Limonges, Ontario

Branching upward like a metallic grove of trees across the grounds of the Calipso Water Park, the hot dip galvanized support structures and stairwells allow visitors to the park to rest easy in the safety and stability of the parks slides and rides. In an environment constantly assaulted by the corrosive effects of water and chemicals, galvanized steel is the perfect solution to protect structural steel from damaging and unsafe corrosion.

Galvanizing not only protects the steel from the point of view of structural integrity and safety, but also, it provides a long-term appearance free of visible rust spots. These structures can carry hundreds of people above the ground, so safety – both actual and perceived – is critical. No one wants to be dozens of feet in the air with their family on a rusty looking structure, and galvanized steel ensures the structures will remain rust-free for decades to come.

The specifier chose to galvanize all structural steel elements, including anchors, supports, and ornamental components. After seeing the attractive, natural, and modern-looking finish of the zinc coating, the owners chose to allow the galvanized pieces to remain unpainted and exposed. Not only did the galvanized finish achieve the vision of the owners, it will provide 50+ years of maintenance-free corrosion protection – meaning lifelong costs associated with paint repair and touch-ups can be avoided, as well as indirect costs caused by shutting down or delaying rides for continuous maintenance.

The principal challenge of this project was the size and complexity of many of the support columns which totalled more than 350 tons of galvanized steel. These highly complex pieces were designed to guarantee proper ventilation and drainage so the final product was functional, safe and free from any galvanizing blemishes or unwanted deposits – especially important, as many railings and stairs will be touched and moved upon by a multitude of park goers.

The superior barrier and cathodic protection of hot dip galvanized steel is particularly suited to this highly corrosive environment, standing up to the daily wear and contact of sun, water, and chemicals. As the largest water park in the country, Calipso's sleek, attractive, and safe galvanized structures will keep the park operational and eye-catching for generations to come.

Galvanizer:	*Corbec Corp.*
Specifier/Architect:	*Village Vacances Valcartier, White Water*
Engineer:	*Genivar/Stantec/White Water*
Contractors:	*MIG Structural Steel – Pommerleau*

The HDGASA *wishes to thank* AGA *for the* USA *contributions.*

On the Couch.....

Charles Taylor

By Desere Strydom

My first encounter with the work of Ballito based architect, **Charles Taylor**, was walking into the **Simbithi Estate Clubhouse** on a "trawling expedition" for Hot Dip Galvanizing Awards entries. The building, seemingly inconspicuous from the parking lot, took my breath away when I walked into the lobby. The intricate hot dip galvanizing and wooden roof structure that canopies the sweeping staircase that leads into the central courtyard, almost made me lose my footing. I knew then and there that I was seeing the work of a disciple of the coating. We caught up with Charles Taylor, architect, hot dip galvanizing devotee and family man.

How did you get into the field of architecture? I had thought of this career path at school, but the deal clincher was visiting an architects office and seeing all the models and visuals.

Please elaborate a little on your education? I had studied in Port Elizabeth, where I also worked for two years. This was followed by a year in London. Upon my return I started my own practice in 1994.

Do you have any role models in the field of architecture that have inspired you? Over the years – Luigi Nervi, Lloyd Wright & Glenn Murcutt.

You are known to be a staunch supporter of hot dip galvanizing. Is this support borne out of the fact that you live and work on the coast? Hot dip galvanizing is the responsible thing to do at the coast, regardless of painting or leaving it in its natural state – I prefer the latter.

Please tell us about your choice of establishing yourself and your practice on the North Coast as opposed to say Durban? This happened in 2000 due to family reasons and also to open a second office as I originally established my practice in Zululand.

Why do you like the hot dip galvanized coating? (You have been known to prefer leaving the coating bare, instead of duplex coating it.) Hot dip galvanizing has a "silver lining" that in my opinion adds an aesthetic value to a structure. It is not dominant but frames materials and highlights structure. It also changes with time and whether it is shiny or matt grey it is appealing.

Structural steel using a hot dip galvanized coating in a residential application is rarely seen. South Africans in general, still seem to prefer the conventional brick and mortar structures. What are your thoughts on the matter? Structural steel is a great material – it is ancient yet modern, recyclable, shimmers in the light, provides an ordered and square structure, often utilised in framed structures like boating, aeroplanes, conservatories, bridges etc, can handle long spans, very easy to fix onto with other materials etc.

Do you think that truly South African architecture exists or do you think that people still look to other countries for style guides? In my opinion, architecture should firstly be a site responsive solution (wherever you are in the globe). Therefore it stands to reason that SA should have a different type of architecture to other countries and even within SA regionally there should be major differences due to climate and topography. After the "responsive" architecture, one can either leave it at that (a modernist type approach) or develop imagery that has historical links such as barn-like farm buildings, verandah cottages, etc.

In your career, which projects that you were involved in stand out as highlights? More recent favourite projects include: Simbithi Clubhouse; House Bailes & House Taylor.

Please tell us about a certain fully hot dip galvanized residential wonder currently being erected in Ballito? (*reference to Charles' own residence – a fully hot dip galvanized structure currently being built*). We bought the property on a public auction in 2003. The 1 acre site was previously the first water reservoir for Ballito from the 1960's and as a result is a naturally high point with dramatic views. Now seven years later we are fortunate to be building the dream house.

Please tell us a little about your family? I was married in 1990 and we have been blessed with four children aged 15,12,10 and 7.

Please share your hobbies and passions. I love sketching; coffee with my missus (double espresso with a touch of milk); studying good buildings on walkabouts (local and overseas); the Bible; red wine (Shiraz) and good food. Other passions include running on the beach; photography and internet companies (I was previously involved with www.privateproperty.co.za mapping solutions and a home improvements portal). But honestly architecture generally – sometimes can't sleep at night with ideas.

When Charles Taylor goes home... The kids take over. Family life is key – all the rest passes away. Once the house is quiet then I am generally designing.

Desere Strydom
http://commentfromthecouch.blogspot.com

Queries can be made to:
admin@ctab.co.za

The alternative metallic coating corrosion control system

As a corrosion protective system it compares very favourably with hot dip galvanizing providing the coating is sealed or painted after application. The reason sealing or painting is necessary is that this facilitates good penetration into the pores and resists moisture penetration as the zinc sprayed coating tends to be slightly porous and retains moisture on the surface longer than hot dip galvanizing. If the coating is not sealed it will eventually oxidise and seal itself. Sealing also provides a smooth texture finish. The zinc spray should be at least 50% thicker than a comparative hot dip galvanized coating.

Once painted or sealed the metal sprayed coating is comparable with a duplex system in every way and will provide a similar life to a hot dip galvanized and painted finish. Zinc sprayed coatings are an excellent base for painting as they provide good adhesion due to the blasting profile that is required for zinc spray of 50 microns. The blasting should also be to a minimum of SA2½ or SA3 cleanliness to ISO 8501-1. The resulting adhesion is excellent and superior to most other applications of paint primers or paints on galvanizing. Other advantages of a metal sprayed coating are:

1) There is no size limitation as in hot dip galvanizing which is limited to the size of the galvanizing kettle.

2) It can be applied on a site.

3) There is no possible distortion due to heat transfer.

4) Heavier coatings than normal can be applied with no adhesion problems.

5) Epoxy primers and polyurethane topcoats are applied to zinc spray and offer an excellent lifetime in highly corrosive environments.

6) Metal Spraying can be undertaken to SANS 2063:2008 specification guaranteeing the quality and thickness of the coating.

7) Zinc spraying is limited to the exterior of a tubular article and it is a requirement that there should be no gaps or holes in the structure that may allow moisture to penetrate and create internal corrosion.

8) Aluminium or Zinc / Aluminium Alloy metal spraying provides better corrosion resistant lifetimes in marine environments or in acidic conditions and can also be used in high temperature applications over 200˚C. Sprayed aluminium or zinc aluminium alloys give noticeably better lifetime in salt spray environments than pure zinc.

9) The biggest single advantage of zinc metal spraying is as a repair method to hot dip galvanized coatings. It is the only repair that guarantees the client or engineer the same lifetime as the hot dip galvanized coating and it can be established on site after repairs or welding has taken place. A famous example in Cape Town is Athlone Stadium where performance guarantees were required as much of the steel arch to which the roof is attached had to be welded and joined on the site. The welded joints were blasted zinc metal sprayed and painted.

10) It provides cathodic protection on cut edges or uncoated areas.

Forth Road Bridge, Scotland.

Disadvantages

It is always necessary to check the coating thickness as it is a man applied process and it cannot be subjected to severe mechanical handling as the coating is more easily damaged than hot dip galvanizing.

In South Africa zinc spraying has always played second fiddle to hot dip galvanizing as some applicators have not applied the coating always to the same consistency as the galvanized coating. Applied as a thin coating it will fail especially if a sealer or paint coatings are not used to overcoat. Applied correctly to the correct thickness and painted it will provide a lifetime equivalent to a duplex system.

In South Africa zinc spraying has been used extensively for the following;

- Bridges including pedestrian walkways across roads that are too large to fit into galvanizing baths.
- Structural Steel including designs that are unsuitable for galvanizing such as large tubular trusses and girder sections.
- As a repair for hot dip galvanizing.
- Garden furniture. Where a smooth exterior and paint finishes are necessary.
- Ships cranes that are used either on trawlers or on the dockside.
- Factory crane rails where perfect straightness is a pre requisite.

Metal sprayed coatings are used worldwide in highly aggressive environments. Some famous international examples where metal spraying has been used for corrosion protection as a primer coating are

- Forth Road Bridge in Scotland
- The Tower Bridge in London
- Refurbishing by zinc metal spraying the metal Tiles on Big Ben
- The Clifton suspension bridge in England
- The Severn Bridge in England
- The Pierre-Laporte Bridge in Canada
- The Bosphorus Bridge which connects Europe and Asia
- Several hulls of ships and boats have been metal sprayed.

The Association wishes to thank Iain Dodds for this article.

PROPOSED FEATURES FOR 2011

Febuary / March (No 46):

• Fasteners and availability matrix • Continuous sheet and wire galvanizing

May / June (No 47):

• Tubes, pipes, scaffolding • Masts and poles • Water storage • Heat exchangers and cooling fans

August / September (No 48):

• Annual Hot Dip Galvanizing Awards • Cable ladders and trays

November / December (No 49):

• The world of hot dip galvanizing around us • Greening of the hot dip galvanizing industry

NOTE: FEATURES MAY BE SUBJECT TO CHANGE

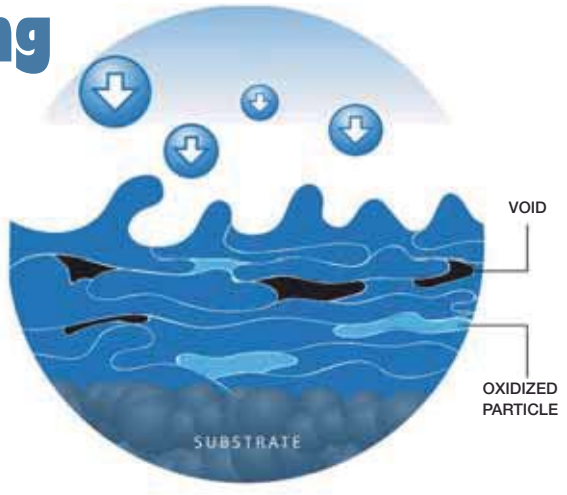
Anti corrosive finishing

Metal or thermal spraying is a technology, which protects and greatly extends the life of a wide variety of products in the most hostile environments and in situations where coatings are vital for longevity. The variety of metallised coatings is vast but can be broken down into two main categories. These include finishing coatings, such as anti-corrosion or decorative coatings, and engineering coatings such as wear resistant and thermal barrier coatings.

Metal spraying is carried out in a wide range of anti corrosion and engineering markets, including oil and gas, construction, petrochemical and marine. Corrosion is a major problem for these industries. There are four commonly used processes in thermal spraying; Flamespray, Arcspray, Plasma Spray and High Velocity Oxygen Fuel (HVOF), but only two of these, Flamespray and Arcspray are normally used for finishing coatings.

The basics

All methods of thermal spraying involve the projection of small molten particles onto a prepared surface where they adhere and form a continuous coating. To create the molten particles, a heat source, a spray material and an atomisation/projection method are required. Upon contact, the particles flatten onto the surface, freeze and mechanically bond, firstl onto the roughened substrate and then onto each other as the coating thickness is increased.

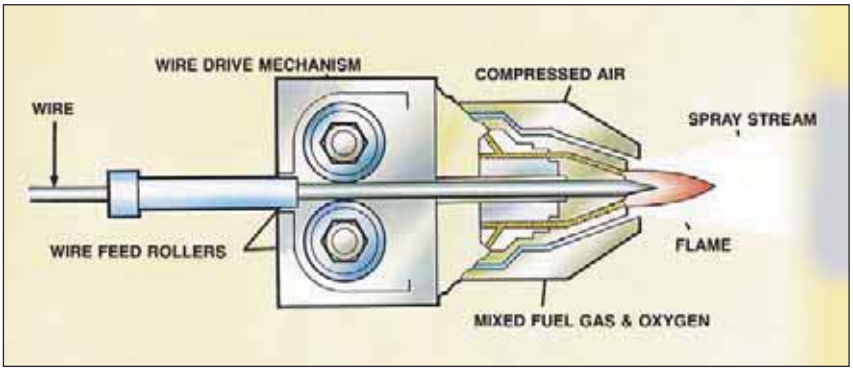


As the heat energy in the molten particles is small relative to the size of the component, the process little heat to the substrat considerably less than 100 C. As the temperature increase of the coated parts is minimal, heat distortion is not normally experienced. This is one major advantage over hot dip galvanizing.

Wire Flame Spray

In the wire flame process used for most anti-corrosion coatings, a wire is fed by a driven roller system through the centre of an oxygen-propane flame where it is melted. An annular air nozzle then applies a jet of high-pressure air, which atomises and projects the molten material onto the work piece. The driving of the wire is typically via an air motor and gearbox that forms part of the pistol. Wire diameters that can be flame sprayed as standard range from 1.6mm to 4.76mm (1/16" to 3/16"). Wire is typically dispensed from coils or production packs (drums).

continued on page 22...



Single wire flame spray gun.

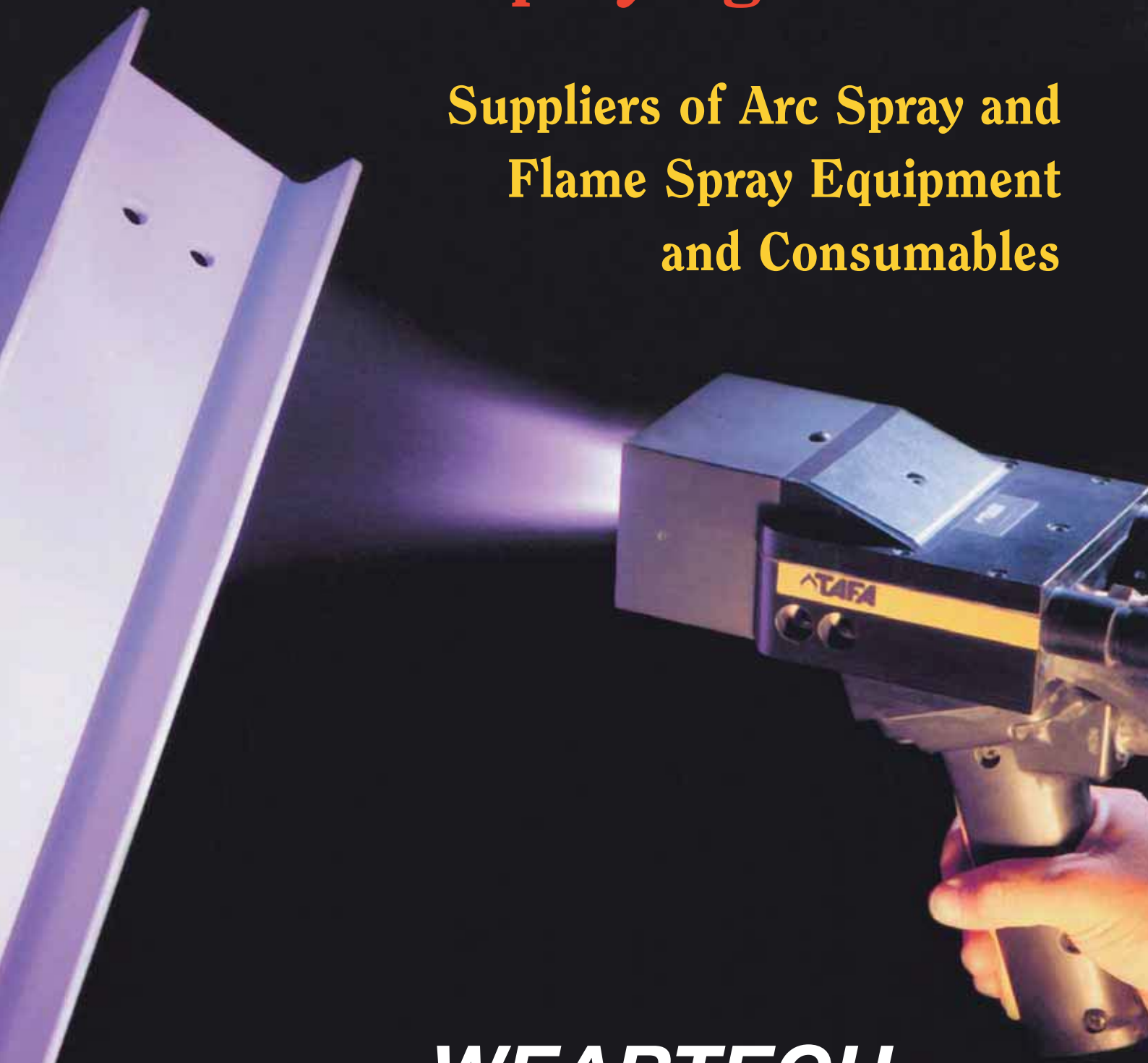
Zinc metal spray equipment for a remote site.

Reconditioning a site weld on a duplex coated component by zinc metal spraying on a remote site.

Achievement of coating thickness must be carefully monitored.

Zinc Metal Spraying?

Suppliers of Arc Spray and Flame Spray Equipment and Consumables



WEARTECH (Pty) Ltd

THERMAL SPRAY DIVISION

187 Galjoen Street, Wadeville
P.O. Box 14125, Wadeville 1422
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Website: www.weartech.co.za

Extracted from ISO14713:1999		
g) corrosivity category Im2: Temperature sea water[d,e]: zinc corrosion rate typically 10μm/year to 20μm/year; 70g/m²/year to 150g/m²/year		
Typical life to first maintenance years	**General description and suitability**	**Mean coating thickness on each surface μm (minimum)**
Very long (≥20)	Sealed sprayed aluminium conforming to ISO 2063 Sealed sprayed zinc conforming to ISO 2063	150 250
Long (10 to< 20)	As above or: Hot dip galvanized (See Note #1) Sealed sprayed zinc conforming to ISO 2063	 150 to 200 150
Medium (5 to <10)	As above or: Hot dip galvanized (See Note #2)	 115
Short (<5)	As above or: Hot dip galvanized conforming to ISO 1461 (steel ≥ 3mm)	 70 to 85
[d] Hot dip galvanized tube, sheet and fittings normally have additional protection when used in sea water. [e] Brackish water may be more or less corrosive than sea water and no general estimates of durability can be given.		

Note #1: For these conditions and life to first maintenance >20 years a very thick galvanized coating is required, eg. 150 to 200μm. Such coatings should not be specified until the matter has been discussed with a hot dip galvanizer and sample products have been satisfactorily hot dip galvanized.

Note #2: Thickness of hot dip galvanizing on products: ISO 1461 specifies the standard hot dip galvanized coating at the equivalent of 85um minimum for steel 6mm thick and more. Thinner steel, automatically hot dip galvanized tubes and centrifugal work (usually threaded work and fittings) have thinner coatings, but usually greater than 45um. Where it is desired to use coatings of different thicknesses to those stated, their lives can be ascertained by calculation; the life of a zinc coating is (to a first approximation) proportional to its thicknes. For tubes, EN 10240 includes an option for the purchaser to specify a thicker coating requirement which will give an extended service life. Hot dip galvanized coatings thicker than 85um are not specified in ISO 1461 but the general provisions of that standard apply and, together with specific thickness figures , may form a specification capable of third party verification. It is essential to know the chemical composition of the steel to be used and the galvanizer should be consulted before specifying as these thicker coatings may not be available for all types of steel. Where the steel is suitable, thick coatings may be specified; the following figures are given as a guideline.

Product and thickness t (mm)	Local coating thickness (um minimum)	Average coating thickness (um minimum)
Steel t ≥ 6	100	115
Steel 3 < t < 6	85	95
Steel 1 < t ≤ 3	60	70
Small centrifuged articles	Not recommended	Not recommended

Thicker coatings than those listed above (eg 150 to 200um) require even more care in selection of steels. With all thick coatings it may be necessary to check the thickness obtainable by hot dip galvanizing a sample product. The composition of iron and steel also affects the rate of reaction of steels with zinc. In general, if the silicon plus 2½ the phosphorus content is less than 0.1%, coherent light grey coatings are likely to form. Good, coherent coatings of controlled-thickness can, however, be obtained on most types of steel.

Part table 2: Corrosivity Category Im2 – immersed sea water – temperate regions.

Twin wire Arc Spray

In the Arcspray process, two electrically charged wires are driven and guided so that they converge at a point and form an arc. An air nozzle atomises the molten metal produced and projects it towards the work piece. The driving of the wires is typically either by air motor or electric motor and gearbox arrangement. The wires can be driven in three different ways, all which offer individual benefits.

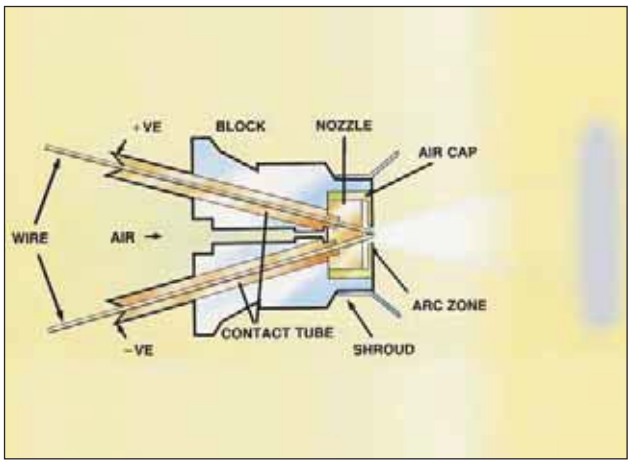
Push only, where the wire is pushed from a drive unit to the pistol. Pull only, where the wire is pulled by a drive unit mounted in the pistol. Push/Pull, this method is obviously a combination of these two methods, where the wire is driven to and pulled from the pistol. Wire can typically be dispensed from portable MIG reels, coils or production packs (drums) depending on the application requirements.

Why use flame or arc?

This sounds like it should be an easily answered question, but, as with many engineering situations, a clear and precise answer is not available. In some instances, the coating properties achievable by one or the other processes does provide a simple answer. For example, arc sprayed aluminium has a bond strength that is approximately 2.5 times higher than flame sprayed aluminium.

Other factors include deposit efficiency, ease of operation, safety/spray environment, changeover time, maintenance time and costs, coating finish and ease of automation.

The above considerations give an insight into the wide range of variables when choosing which process to use. It is worth mentioning that a matter of personal or local market preference can also be added into the decision matrix.



Twin wire arc spray gun.


Above average size components can be zinc metal sprayed on site.

Effectiveness of metallised coatings

Thermal Spraying is not a new process. It has proved itself to be extremely effective in the 90 years of its existence in all manner of applications ranging from coatings in gas turbines to corrosion protection on park benches. As a protective system for structural steelwork it is unsurpassed being the only system, recommended by International and European standards EN ISO 14713 as giving greater than 20 years to first maintenance in very aggressive environments such the marine splash zone (category lm2) as well as all other categories.

Material selection and typical applications

As can be seen from *table* 2, two commonly used materials for corrosion protection are aluminium and zinc. A third material is zinc/aluminium alloy (85%Zn /15%Al). The choice of material to be used is a vast topic with many factors to be taken into consideration such as environment (corrosive atmosphere, temperature etc.), local authority specifications, life expectancy of the coating, adhesion requirements, availability of material to name but a few.

In general terms, zinc is used in reasonably less corrosive environments such as water tanks, some bridges and general structural steelwork. Aluminium is used in harsher corrosion environments such as saltwater and splash-zone areas. In addition, aluminium is used in high temperature applications such as flare booms on offshore oilrigs as the aluminium effectively dissolves into the substrate (aluminises) when exposed to high temperatures.

Zinc/Aluminium alloy is used in environments where the corrosion resistance of zinc is borderline.

Metal spraying is a very flexible process. The range or materials that can be sprayed is almost limitless. In effect, if a material can be heated to

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Flame spraying a component.

its melting point without boiling away, the material can be sprayed. Other common materials used in finishing applications are Copper, Aluminium/ Bronze and Phospor/Bronze, often used for decorative purposes. Also, a wide range of steel materials can be used for corrosion and wear protection.

The range of applications that metallising is used for has mainly developed as a result of the limitations of other available processes. For example, new bridge sections are often sprayed to offer maximum corrosion protection. The 'I' beams can be as much as 40m (120ft) long, 4m (12ft) high and 2m (6ft) wide. Obviously, this is too large for the average hot dip galvanizing tank. The process is also transportable, so structural steelwork can also be sprayed on-site or repaired where on-site welding has removed the hot dip galvanizing.

Other common anti-corrosion application areas are off-shore oil platforms, ships, fences, underground pipes, electric rolled welded (ERW) tube manufacture, multi-void aluminium tube manufacture, LPG cylinders, water / fuel tanks, external and internal steelwork and playground furniture. This is a very short summary of a virtually endless list of applications.

The Association wishes to thank Weartech for this article.

Zinc and aluminium metal spraying

In late 2009 Galvaspin introduced thermal metal spraying as an alternative to hot dip galvanizing due to size, structural and cosmetic limitation we experienced in hot dip galvanizing.

We have carried out a wide range of anti-corrosion projects which including markets in the construction, marine industries and domestic. The methods of thermal spraying involve the projection of small molten particles onto a prepared surface where they adhere and form a continuous coating. Upon contact, the particles flatten onto the surface, freezes and mechanically bond. Firstly onto the abrasive blasted substrate and then onto each other as the coating thickness is increased.

Over the years we have noticed heat distortion in plates and other items we have hot dip galvanized and have since eliminated the problem successfully with thermal spraying. As the heat energy in the molten particles is small relative to the size of the sprayed component, the process imparts very little heat to the substrate. As the temperature increase of the coated items is minimal, heat distortion is not experienced.

The effectiveness of thermal spray coatings has proved itself to be extremely effective in the 90+ years of its existence. The range of applications that metallising is used for has mainly developed as a result of the limitations of other available processes. As an example, new bridge sections are often sprayed to offer maximum corrosion protection. Some structures are sometimes too large for the average hot dip galvanising tank.

The process is also portable so structural steel work can also be sprayed on-site or repaired where on-site welding has removed the galvanizing. Other common anti-corrosion application areas are splash zones, fencing, burglar bars prior to decretive paint coatings, underground pipes, LPG cylinders, water / fuel tanks, external and internal steelwork and playground furniture. This is a very short summary of a virtually endless list of applications.

Henning van Wyk, Galvspin Port Elizabeth.

Advanced Galvanising leads the greening of the hot dip galvanizing revolution

One of Cape Town's hot dip galvanizing companies, Advanced Galvanising (AG), has taken their first clean, green step towards running their systems in an almost entirely eco-friendly way. Working in conjunction with VJL Technologies (Pty) Ltd. AG successfully commissioned a specialised Water Treatment Plant designed to recycle 100% of their rinse and waste water.

The AG plant is situated in Bellville, Cape Town and works mainly with architectural and industrial steel, which is brought to the plant from the fabricators. Before the raw steel can be hot dip galvanized it has to be pre-treated.

The pre-treatment process involves the raw steel being cleaned of all oils in a highly alkaline degreaser before being rinsed (neutralised) and then sent through the acid treatment. The pickling acid removes scale and surface contaminants. After the raw steel has been perfectly cleaned it is processed through the zinc ammonium chloride-based flux bath, designed to promote the metallurgical reaction between the steel and molten zinc. The zinc ammonium chloride dried film now on the steel surface, also prevents premature oxidisation of the cleaned steel prior to hot dip galvanizing.

The water used in the various rinsing processes is vital to ensuring that there is no alkaline or acidic residual (drag out) that is carried over into the fluxing solution. As a result of drag out from both the degreaser and acid pickling, the all rinse-water must be continually replenished.

Polluted water cannot be released directly into the council waste-water system, and in the past, cost of disposal of the contaminated rinse water was exorbitant and extremely wasteful. Of critical importance it is this polluted water that usually ends up in rivers and oceans due to illegal dumping. A low rinse quality also impacts on the quality of the products produced and acid / flux consumption.

Advanced Galvanising in conjunction with the VJL Technologies (Pty) Ltd. team has now set a precedent within the region as the first hot dip galvanizing plant that is recycling 100% of their process water. It is this kind of forward thinking by major corporations that demonstrates the possibilities that green business awards these companies.

It was Johan Louw, AG's Managing Director, who approached and worked closely with the engineering designer of the Water Treatment Plant, Shawn Williams. Not only has this eco-action saved the company large quantities in water bills, but it is an exceptional example of the steps that can be taken by large businesses in preserving our natural resources and environment. When asked what inspired him to instigate the installation of the Water Treatment Plant he responded, "I feel we all have a responsibility to do business in a responsible manner and I do think that we as a company also have a

continued on page 26...

Sump construction 1 – casting.

Sump construction 2 – casting.

Sump construction 3 – casting.

Sump casting complete.

Effluent treatment plant – Installation day 1.

responsibility towards our descendants to protect our environment".

Instead of sending their waste-water on to the council, AG's rinse-water is treated in the Water Treatment Plant and then fed back into process. There is absolutely no water wastage.

The Water Plant has three large sumps: the alkaline stream, being fed from the Galvanizing plant, runs into one sump, and the acid stream runs into one of the other sumps. Each sump's capacity is 35 000 litres. From these sumps the contaminated water is pumped through the treatment plant, where iron and other toxicities are removed. Once processed the water is returned to the rinsing systems of the Galvanizing plant. The metal and zinc removed during this purification process comes out in a solid form that potentially can be used as raw material used to make bricks.

Here is a brief explanation of how the Water Treatment Plant works:

The water is drawn up into the reaction vessel where the pH of the water is raised using lime, after which a poly-electrolyte is added to the mixture. The poly-electrolyte then binds itself to the metals inside the water making it sink to the bottom and is then left behind, dropping out of the clarified water.

The treated water comes out of the purification process completely clear and clean, before being sent back to the

Effluent treatment plant – Installation equipment placement day 1.

Completed effluent treatment plant.

processing plant. The metals that are left behind are pulled into what is called a "Sludge Tank" where the mixture is filtrated before the solid metal cake is removed.

With Johan Louw being an environmentally aware manager at the helm of Advanced Galvanising, the company is clearly on its way to becoming one of the country's more eco-friendly operations. Johan Louw has already hinted at future projects to be undertaken in collaboration with VJL Technologies: "We are currently working with [them] on an exciting new project which will be commissioned in January 2011". It really is inspirational to see a company such as AG taking a real interest in issues that matter.

The Association wishes to thank VJL *Technologies for this article.*

Galvaglow goes green

Galvaglow (Pty) Ltd is a modern hot dip galvanizing plant which utilises the very latest and most up to date equipment in South Africa. It has taken three years of careful planning, hundreds of meetings and a lot of support from many people and finally the plant is complete.

Gina Gerber, the CEO of Galvaglow, has sourced all the plant and equipment from a selection of the finest companies in this industry. The plant boasts a large 4 metre x 2.5 metre x 1.5 metre kettle manufactured by the well known Pilling Group in Switzerland. The Furnace was manufactured by Gemico in Italy and will be the only new technology "high velocity fired gas furnace" operating in a galvanizing plant in South Africa.

Polypropalene tanks with hot water system and pumps to circulate acid water.

According to Gina Gerber "Galvaglow is one of the only plants to abide completely with the latest legislation in South Africa in terms of the new EIA laws. Which makes us the most environmentally friendly plant currently operating in South Africa.

The plant has been designed to include a hood over the kettle. The civil works have already been completed for our own water treatment plant on site. The entire building has been enclosed with the use of polyethylene sheeting which is also corrosion free.

A fume extraction system has been installed using a wet scrubber. This will operate in the pre-treatment area only, which is entirely enclosed so as not to allow gasses to escape and pollute the air. A custom made dryer has been installed which will convert the excess heat from the gas furnace and tunnelled through a blower to dry the products so as to avoid excess splashing around the kettle whilst dipping. Thus allowing us to use less energy and achieve a more efficient zinc consumption. This will also eliminate the amount of smoke coming off the kettle.

The pre-treatment plant has ten polypropylene tanks which were manufactured locally using the finest materials available. Being polypropylene material they are low maintenance and corrosion free. The passivation which is being used is chrome 6 free and is just another indication of our dedication to operate the most environmentally friendly plant in the industry. These tanks also have pumps installed on the tanks to circulate the acid which will allow us to pickle faster and therefore run our acid to a lower count before replacing it. These tanks will be heated from excess

Scrubber system to purify acidic gases extracted.

Enclosed factory with extraction system.

exhaust gasses given off by the furnace and redirected to heat the hot water pipes which in turn will heat the flux and degreaser tanks thus saving energy once again.

Galvaglow has now set a new standard in the industry which we hope other galvanizers will follow. No money was spared in setting up the plant in an effort to ensure that we have the most modern equipment in the country.

Galvaglow is situated in Krugersdorp in premises which we own and share with a number of associated companies in the group.

All galvanizing will be done to strict SANS 121 (ISO 1461) standard ensuring that you will receive the finest coating quality."

"DEPENDABLE DYNAMIC DIVERSE"

The Association wishes to thank Galvaglow for this article.

Bob's BANTER!

Natural laws show how value can be added

'Added value' has become the new focus in the corporate world. Executives are seeking ways to increase shareholder value; managers are striving to increase the value of their departments' outputs and employees are being asked to add value by working harder and smarter.

Is added value just a question of achieving greater performance at the same cost? Are there other ways to add value? Are there any rules or guidelines that can be followed?

Kevin Kelly (Out Of Control) has observed various 'laws' in natural systems that are used to "make something out of nothing". Many of us would agree that this is how we see adding value: having to do something when there is no more time available; having to make something with no money; having to provide a better service with no extra staff.

The first 'law' is to seek disequilibrium. Change can only happen in an unbalanced system. In nature nothing happens if the system is in equilibrium: think of two blocks of metal in contact with each other- heat will only flow between them if they are at different temperatures. So too with people: creativity stems from dissension or dissatisfaction.

Another 'law' is to have multiple goals. Seeking to maximise a single goal will have fewer returns than exploring a wide range of different goals. As Kevin Kelly puts it: "wealth is not gained by perfecting the known, but by imperfectly seizing the unknown". Natural adaptive systems are seldom optimal. They are usually just 'good enough' rather than being perfect.

Ensuring diversity is an important 'law'. A uniform system can only adapt by an occasional massive change and stands the risk of being eliminated if the change does not work. Diverse heterogeneous systems

can adapt by a multitude of continuous small changes that keeps it in a state of permanent change. Diversity speeds up adaptation, increases resilience and is almost always the source of innovations.

Start simply. Complex natural systems work because they began with a simple system. Installing a highly complex organisation 'overnight' will inevitably lead to failure. Time is needed to allow simple systems to test themselves against each other. Assembling the simple systems then creates the final complex structure.

Distribute authority. The 'being' of a system, e.g. the 'life' in a human, the behaviour of an economy or the competitive edge of a company, is distributed over a multitude of smaller units. Interaction of the smaller pieces produces the synergy that provides the platform for added value.

In a distributed system everything is connected to everything and everything will happen at once. Wide ranging and fast moving problems, requiring rapid decisions, cannot depend on a central slow-moving authority. Adding value means moving fast and control needs to be distributed.

Cultivate positive feedback. Each time a new idea is used, new knowledge is obtained. This will reinforce the idea and make it more likely to be used again: the idea will produce increasing returns. All sustaining systems play the game of increasing returns: confidence breeds success.

New ideas are needed all the time. A unique concept or product will only work for a time, until everyone else is doing it. To advance from the ordinary requires a new direction into unfamiliar territory. Moving around in a strange territory and doing weird things can be viewed as making mistakes. Mistakes must thus be accepted as an integral part of the process of value creation. As William Blake said: "to be an error and to be cast out is a part of God's design".

Probably the most important 'law' is that change processes can be structured within a system and can change themselves. In large complex natural systems, the 'life' process is the co-ordination of change. Each constituent part of the system interacts with other parts to initiate the 'rules' of change. Over time the 'rules' themselves get changed. Evolution is the study of how the rules for changing systems have changed.

For continuous added value an organisation needs self-changing rules. The role of management should not be to set the rules for change but to allow the constituent parts of the company to do this. Their job is to co-ordinate the process.

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

"It only works when you don't need it!"

In this third article in this series, we explore design and structural considerations in the use of galvanized reinforcement in concrete construction. The final article will cover typical applications of galvanized reinforcement and present a portfolio of world-wide applications.

Design of galvanized reinforced concrete

There are no special requirements for the design of galvanized reinforced concrete beyond that which apply to conventional reinforced concrete. In particular, splice and lap lengths are the same as for black steel bar, as are bond and load transfer considerations. In effect, best practice when utilising galvanized reinforcement is to use appropriately designed and placed concrete as would normally be used in general reinforced concrete construction. There are however some technical matters that require consideration.

Cracking of the galvanized coating

One of the major concerns of engineers and fabricators is cracking of the galvanized layer during bending and whether this causes a loss of adhesion to the steel. Considerable testing on this has been done and it is clear that if appropriate bend radii are used (as previously discussed) the risk of cracking and any effect on the coating adhesion can be minimised. In essence, smaller diameter bars perform better in bending and the coating adhesion steadily improves as the bar diameter is reduced. Very tight bends (around 2d), especially in high tensile bars may cause some cracking of the coating though increasing the bend radius to even 3d can avoid this issue.

Many bend tests have shown that the extent of cracking and the width of cracks in the zinc coating are influenced by the bend radii, the diameter of the bars, the angle of bend, and the thickness of the coating. In general, the smaller the bend radius, the larger are the cracks; and the thicker the coating the greater the intensity of cracking. Cracking in the coating will invariably occur at right angles to the length of the bar and if the cracking causes local de-bonding between the coating and base steel, the durability of the coating may be compromised. In practice therefore it is safer to galvanize bars after bending if at all possible.

The corrosion susceptibility of bent galvanized bars with cracked coatings has shown that corrosion does not preferentially occur at the cracks

produced by bending. It appears that zinc oxide corrosion products blocked the cracks in the coating thereby preventing localised corrosion of the base steel. The zinc coating also has good inherent

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Type of Steel	Considerations for Galvanizing
Low strength grades - 250 MPa yield strength	• no effect on mechanical properties provided the bar has not been excessively cold worked during fabrication.
Cold-twisted steels (Grade 410C) - 410 MPa minimum yield	• double cold-worked material (i.e. to strengthen during manufacture plus fabrication by bending) may be embrittled by galvanizing; and so • requires expensive stress relief heat treatment.
Thermo-mechanically treated or micro-alloyed grades (Grade 410Y) - 410 MPa minimum yield	• can be satisfactorily galvanized without need for any special requirements; and • no significant effect on strength or ductility.
New generation high strength bars (Grade 500N) - 500 MPa minimum yield	• superior mechanical properties are retained after hot dip galvanizing; and • testing actually showed a slight improvement in yield and ultimate stress and also ductility.

Table 1. Summary of reinforcing steel types.

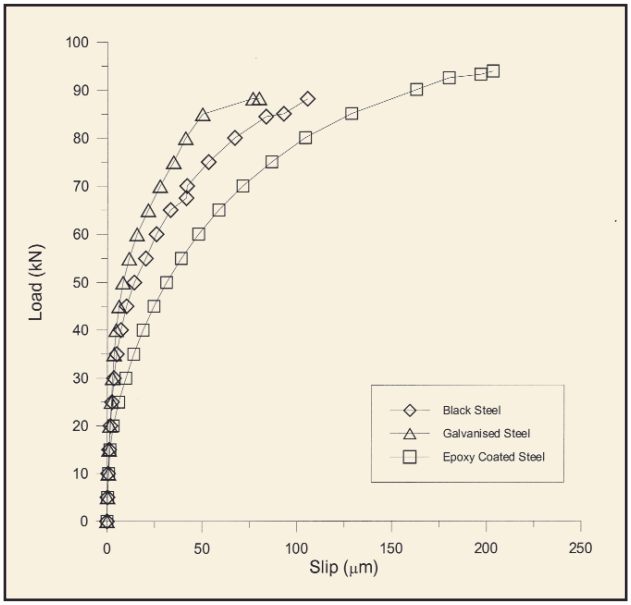

Figure 1. Load-slip data for black, galvanized and epoxy coated ribbed bars.

resistance to abrasion and impact and testing has shown that transportation of galvanized bars, and normal concreting operations, will not damage the coating.

Mechanical properties of steel bars

Extensive testing has confirmed that galvanizing does not adversely affect the tensile mechanical properties of conventional reinforcing steels (around 250 MPa) providing such steels have not been excessively cold worked prior to galvanizing (e.g. bending and re-bending).

There is some evidence that cold-twisted, high strength bars (around 400 MPa) which had been subsequently bent during fabrication may be embrittled by galvanizing. This problem was however effectively eliminated by the 1970s with the introduction of thermo-mechanically treated steels and micro-alloyed steels for high strength bars (minimum yield of 400 MPa) as replacements for cold-twisted reinforcing steel. More recently, higher strength reinforcement to 500 MPa yield has been introduced and extensive testing has again verified that the mechanical properties of this material are not adversely affected by galvanizing. A summary is given in *Table* 1.

On the other hand, zinc has low fatigue strength and consequently the fatigue behaviour of zinc-coated bars is affected more than their static properties. While not a major concern, this may need to be taken into account for structures designed to withstand earthquake forces.

Bond and slip characteristics

The bond between concrete and the reinforcement is essential for

developing the full capacity of the reinforcement. The single largest contributor to bond between the bar and the concrete is whether the bars are ribbed (i.e. deformed) or smooth (i.e. plain). If the bars are smooth, the bond strength is due solely to chemical adhesion and frictional between the bar and the concrete. If the bars are ribbed, the bearing of the concrete on the deformation ribs and the shear strength of the concrete between the ribs become predominant.

In the use of galvanized reinforcement the principle issue is whether there is any significant difference in bond and slip compared to conventional black steel bars. A significant amount of research has been undertaken in this area and some key outcomes of this research from are as follows:

- the time to develop full bond strength for galvanized bars may, in some circumstances, be longer than that for black steel though this effect is usually overcome prior to 28 days curing;
- galvanized smooth bars have superior bond strength to equivalent black steel bars, though in some cases not as good as pitted and rusty steel bars, thereby indicating the sensitivity of the bond strength to the roughness of the surface;
- there was no significant difference in the ultimate bond capacity of ribbed black steel or galvanized steel bars; and
- in beam tests, at ultimate load there was no significant difference in the free-end slip of galvanized bars and black bars. At intermediate loads there was a noticeable reduction in slip for galvanized bars compared to black steel bars as shown in Figure 1.

What is clear is that the bond of galvanized bar is no less than that of equivalent black steel bar; in fact it may be higher than that of black steel. Multiple comparative studies undertaken at the University of

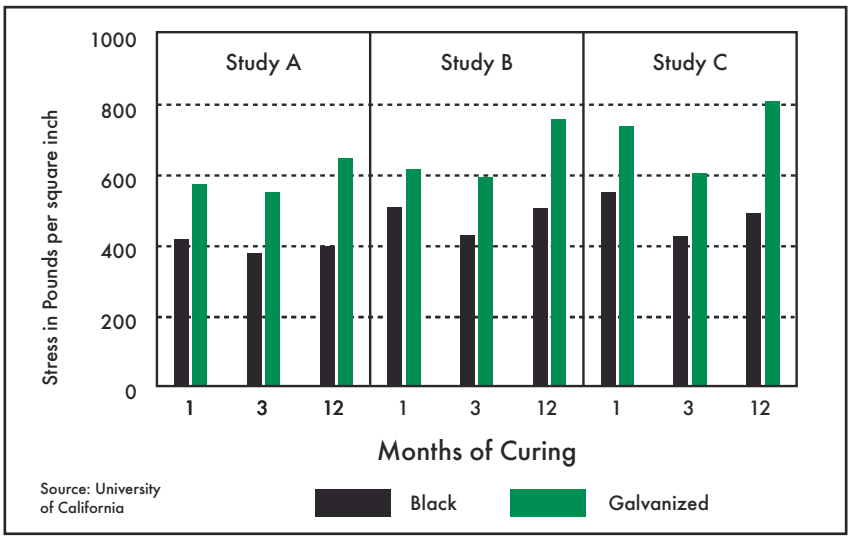

Figure 2. Comparing the bond strength of black and galvanized bars.

California (*Figure* 2) clearly shows this effect. In practice however, though the bond strength is usually somewhat higher than that with black steel bars, this is not taken into account in the design of galvanized reinforced concrete. It is simply assumed that the element will behave as if it is reinforced with black steel.

Despite this, questions are often raised about the effect that hydrogen

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evolution, as a result of the reaction between zinc and wet cement, may have on the bond capacity, and the use of chromates to overcome this perceived problem.

The issue of hydrogen evolution

As mentioned in part 2, when galvanized steel comes in contact with wet cement, the formation of calcium hyrdoxyzincate at the surface of the bar is accompanied by the evolution of hydrogen gas bubbles. Because this reaction ceases once the cement starts to harden after the first few hours, only quite small quantities of hydrogen are produced.

In mass concrete with significant quantities of coarse aggregate and entrained air, the hydrogen bubbles are well distributed in the concrete matrix and can rarely be separately identified. In light weight concretes with low volume fractions of coarse aggregate, such as may be used in precasting, the bubbles may accumulate and rise though the concrete cover. This may, in some circumstances, result in variations in the texture of the concrete at the surface of the precast panel which may be aesthetically undesirable.

While the evolution of hydrogen may occur, the issue of whether this will reduce the bond strength of galvanized bars in concrete is often over-emphasised. As noted above, this matter has been widely investigated and has revealed that there was no reduction in bond strength for galvanized bars compared to equivalent black steel. A key aspect of this is that the hydrogen evolution from galvanized steel immersed in cement paste occurs on surfaces where iron and zinc are both present and not from pure zinc. This suggests that it is the zinc-iron alloy layers in the coating which initiates the formation of hydrogen and that this should not occur to any significant extent on the pure zinc outer surface of bright (i.e. non-reactive) galvanized steels.

It is to be noted that hydrogen evolution, should it occur, can be effectively eliminated if the coating is passivated by another means. This can be achieved by treatment of the freshly galvanized steel with a variety of chemicals, the most common of which are chromate salts.

The role of calcium hydroxyzincate (CHZ)

The CHZ that forms due to the reaction between zinc and wet cement is known to positively contribute to the bond between the reinforcement and the surrounding concrete. Detailed microscopic examination has shown that this product acts as a physical anchorage between the coating and the surrounding concrete thereby strengthening the level of adhesion of the bar. This effect is qualitatively confirmed in the observation that Portland cement mortar droppings adhere strongly to zinc and when fully hardened become very difficult to remove without damaging the metal. Equally, it is well-known how difficult it is to remove hardened concrete from galvanized bars, a process that occurs easily with black steel bars.

Since the adhesion between the zinc and cement paste is relatively stronger than that between the steel and the paste it can reasonably be inferred that the strength of the bond so formed with concrete compensates for any potential loss of bond due to the hydrogen evolution. Further, this high level of adhesion also accounts for the reduced load-induced slip of galvanized bars shown in *Figure* 2.

The need (or not) for chromate treatment

The prevention of hydrogen generation on the surfaces of galvanized steel, by precluding the reaction between zinc-coated reinforcement and fresh cement, can be achieved by the

application of a dilute chromate solution to freshly galvanized steel. ASTM A767 includes such a requirement and ISO14657 states that "if specified by the purchaser, the galvanized coating shall be chromate treated".

Chromate passivation as it is called can be achieved by quenching freshly galvanized bars in water containing 0.2% sodium dichromate (i.e. 2 kg per m3 of water) or a 0.2% chromic acid solution. The bath needs to be at a temperature of at least 32°C and the bar needs to be immersed for at least 20 seconds. If the bar has cooled after galvanizing, sulphuric acid (0.5-1.0%) needs to be added to activate the bars. An alternative method is to add chromates to the concrete mix water in the form of sodium or potassium dichromate at a rate of 70 ppm expressed as CrO3 by mass of cement. This is equivalent to 104g/tonne of cement of pure sodium dichromate dihydrate or 103g/tonne of cement of pure potassium dichromate.

The advantage of the concrete mix-water addition approach is that it ensures that the galvanized product is passivated at the actual time it is cast into concrete. For bar that is quench passivated immediately after galvanizing and then fabricated, transported and stored on site, there can be no guarantee that the passive film remains on the surface at the time of casting. The reason for this is that the chromate film on the surface of zinc deteriorates over time, the rate of this depending on both the nature and severity of the exposure.

The effect of chromate passivation on the bond of galvanized bars has been widely investigated. What this body of work has shown is that the bond strength of non-chromate treated galvanized bar is consistently and significantly higher than that of equivalent black steel, and that chromating (when applied) actually increases the bond strength of galvanized bars. What this points to, and which is now widely recognised, is that the requirement to chromate passivate galvanized reinforcement is not at all necessary and the practice should be abandoned in general construction.

It is to be noted that abandoning this practice would also conform to health and safety and also environmental requirements in many countries regarding the use of chromates. It would also make the handling and use of galvanized steel much safer, easier and possibly cheaper. To some extent, the approach adopted in ISO 14657, by allowing an option for chromate passivation, recognises these trends in the recent research indicating that chromate passivation is not really necessary.

In the final part of this series typical applications if galvanized reinforcement in concrete construction will be discussed. A range of world-wide examples will be show-cased.

Professor Stephen R Yeomans, Senior Visiting Fellow, University of New South Wales, Canberra, Australia.

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

3 CPD POINTS

Revised 3-day Galvanizers Inspectors Course for 2011

Hot dip galvanizing is one of the most widely used methods of protecting steel from corrosion. During fabrication and after hot dip galvanizing the coating is inspected for compliance with the relevant specifications.

Following up on comments received from the many participants attending our regular two day inspector courses over the last nine years, we have expanded and updated our two day course. Starting in early 2011, see below for details, we will be introducing a three day course.

Included are revisions of the course material and the introduction of more practical activities in the form of a full morning at a hot dip galvanizing plant followed by an afternoon of Duplex coatings. The galvanizing plant visit examines materials prior to galvanizing and hands on inspections of finished product. The afternoon is a visit to a paint applicators yard and Duplex coatings systems. Included are demonstrations on chemical cleaning and/or sweep blasting, examination of resulting profiles and followed by the application of paint onto galvanizing. The course will provide delegates with sufficient knowledge to advise on fabrication for successful hot dip galvanizing and also test, inspect and interpret test results after hot dip galvanizing.

COURSE DURATION AND CONTENTS

Day 1	**(08h00 to 16h00)**
Lecture 1	Introduction to the Environment, Steel & Corrosion
Lecture 2	Understanding Zinc Coatings (How does Zn protect)
	ISO 9223 & 12944
Lecture 3	Designs, Fabrication and Inspection before hot dip galvanizing SANS (ISO) 14713:1999
Lecture 4	General Hot Dip Galvanizing Processes
	SANS 121 (ISO 1461:1999) Batch type galvanizing
	SANS 32 (EN 10240: 1997) Automatic T & P
	SANS 10094:2007 HDG of Friction Grip Fasteners
Day 2	**(07h00 to 16h00)**
	Hot Dip Galvanizing Plant Visit and Inspection
Lecture 5	Duplex Coatings and HDG Reinforcement in Concrete
	Duplex Coatings Plant Visit and Applications
Day 3	**(08h00 to Completion of Exam)**
Lecture 6	Inspections after Hot Dip Galvanizing
Lecture 7	Quality Assurances in Coating Applications
	Application of specifications
	Control documentation for a QA System
	Examination on Course Effectiveness

Course schedule may be altered and interesting activities added for the benefit of delegates.

Following the course and successful result in a three part exam, the delegate will be issued with a certificate and if required, registered as an approved HDGSA Galvanizing Inspector. Registration will be confirmed on an annual basis. Successful galvanizing inspectors will become Affiliate Galvanizing Inspector Members of the HDGASA for the year.

VENUE AND NUMBER OF DELEGATES

The courses are usually run in Johannesburg from the Hot Dip Galvanizers Association in St Andrews, Bedfordview and also from a suitable venue in Cape Town. Bookings are limited to 10 people per course on a first come first serve basis.

DATE AND TIME

Courses commence at 08h00 sharp and end at 16h30 (or as otherwise instructed). Lunch and refreshments will be provided. Comprehensive course notes can be collected from our offices two weeks before the course (this is highly recommended).

Johannesburg:
15 to 17 February; 15 to 17 March; 19 to 21 April; 17 to 19 May; 21 to 23 June; 16 to 18 August; 4 to 6 October; 22 to 24 November.

Cape Town:
8 to 10 March; 14 to 16 June; 6 to 8 September.

Special courses can be arranged for a minimum of 6 delegates at appropriate venues in South Africa.

COURSE COST AND PAYMENT TERMS

R4 200.00 per person exclusive of VAT. Should you have two or more delegates from the same company, course costs will be R4 000.00 per person exclusive of VAT. Please note that payment is due on the first day of training. Cheques are to be made out to "Hot Dip Galvanizers Association SA". Members qualify for a discount.

CONTINUOUS PROFESSIONAL DEVELOPMENT (CPD)

By attending the Association's 3 day course Galvanizing Inspectors Course, you will obtain 3 points (accredited by ECSA).

SHOULD YOU BE INTERESTED, KINDLY CONTACT SASKIA SALVATORI OR MARJORIE MONTGOMERIE AT THE ASSOCIATION

The case for duplex coating on a hot dip galvanized substrate in an aggressive (C5) environment

The ultimate challenge for the paint industry!

Some five years ago, I read an encouraging article in "Hot Dip Galvanizing Today" penned by the late Walter Barnett under the heading "*Corrosion: The common enemy*". Whilst Walter's conclusions derived were uplifting and constructive I found that my personal experiences of duplex coatings (hot dip galvanizing plus painting) painted a very different picture.

I include the last three paragraphs of Walter's article in HDGT no. 22 to which I referred, as well as my response in HDGT no. 23 for reference purposes:

"Jan van Eijnsbergen's research and recommendations are contained in a publication entitled "Duplex Systems" (hot dip galvanizing plus painting), first published in 1994. This book contains valuable technical information.

Encouraged by this development, the hot dip galvanizers invited the paint fraternity to form a combined committee to evaluate the effectiveness of duplex coatings as well as to develop appropriate paint specifications and application procedures. The co-operation between paint and galvanizing organisations was outstanding and this led to the publication of two documents, the first of which specifies appropriate paint systems for use in conjunction with a hot dip galvanized coating while the second is a code of practice for paint application.

What does all this teach us?

We are fighting a common enemy that is corrosion. To fight each other for supremacy is inexcusable, to unite our efforts is the professional approach that is in everyone's interest. What better example than the Duplex concept!"

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More often than not when a duplex coating fails, substrate preparation, paint type, film build or the environment at hand has not been adequately considered.

I responded:-

"Dear Walter,

As always, I read your above article with considerable interest. After taking in the last two paragraphs, however, I could not help feeling that, as positive as your conclusions may have been, that the reality concerning Duplex Coatings in our country, in many cases seemed to indicate that the political divide between the paint and hot dip galvanizing fraternity is alive and well.

As a layman, I have learnt to respect the fact that corrosion prevention and barrier protection by way of a protective coating system is a highly complex subject, which requires the application of specialised knowledge, research and commitment of both the manufacturers of chemicals, paints, powders and applicators (including hot dip galvanizers).

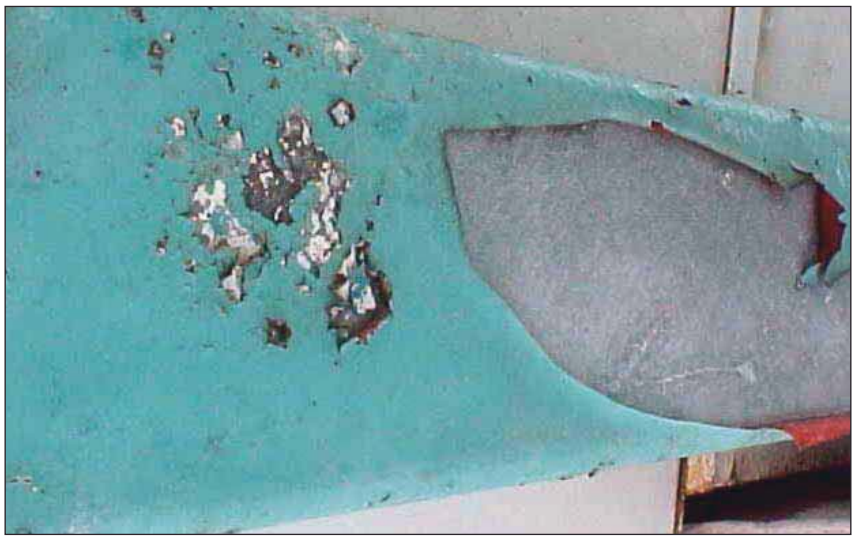
The role and responsibility of the knowledgeable specifying body or specifier is paramount in order to achieve a correctly designed and reliable barrier protection coating system, which will protect the product for its design life in each specific corrosion environment. In addition, the specifier should be responsible for approving and appointing the Duplex applicator, secure in the knowledge that such party fully understands the importance of following each step of the coating process to the letter (including the chemical pre-treatment or sweep blasting).

The very fact that Duplex systems have failed in harsh South African coastal environments with costly repercussions, in my opinion, indicates clearly that a great deal more work has to be done before Duplex Systems find their rightful place in the Southern African environment. This means that paint and galvanizing bodies will have to set aside their primary objectives to promote their own coatings in opposition to each other and embrace the Duplex concept with the enthusiasm of the late paint chemist, Jan van Eijnsbergen.

Until then, I am afraid that I will definitely not promote the undeniable potential benefits of Duplex Systems to unsuspecting customers. I shall rather advise them of the very real risks and liabilities associated with coating on hot dip galvanizing and instead promote guaranteed paint systems, hot dip galvanizing and correct material selection."

My experiences of a duplex paint failure on the West Coast of Southern Africa had left me disillusioned and acutely aware of the extreme risks that contractors face alone when applying coating systems that must fly in highly aggressive environments. Rather than wishing to apportion blame to any single party in the hot dip galvanizing or paint fraternity, I would prefer to record my recommendations for a reliable and successful duplex coating system on hot dip galvanizing in highly aggressive environments:

1. I borrow Walter Barnett's references earlier in his article to being struck by the title of a technical document published by an expert in the South African paint industry some 45 years ago: "Hot dip galvanizing, the ideal primer on which to apply a paint system". For a commercially successful duplex coating system to emerge for general use in highly aggressive environments in South Africa, it is essential that the entire paint industry buys into this challenging statement of fact.



Inadequate preparation prior to painting.

OMISSION

The previous magazine No. 44 had an article *"The bookmakers firm favourite"* written by Pieter Uys of Strutfast, an Affiliate Member of the Association. I erroneously omitted to acknowledge the source of the article, for which I apologize! Thank you Pieter for compiling this interesting article and highlighting my error! ***Editor***

Inappropriate paint and insufficient paint DFT can contribute to a duplex failure.

2. The paint industry and not the hot dip galvanizing fraternity should guarantee the paint coating. If the paint manufacturer does not guarantee his product, then he should not be specified in the first place. This effectively means that the paint manufacturer must take responsibility for approval of the applicator, who should take full responsibility for the hot dip galvanized substrate!
3. This magazine, Hot Dip Galvanizing Today, has done more than its share to encourage the paint industry to participate. It is time for the paint industry to reciprocate by coming to the party. The hot dip galvanizing fraternity needs you to apply your minds to producing commercially viable duplex paint systems on our hot dip galvanized coating in order to perform in a C5 environment, please.
4. This magazine should stop singing the praises of successful duplex systems, without publishing well known duplex failures. One does not learn from success – one learns heaps from failure. It is my contention (possibly misguided) that a very large proportion of so- called duplex successes, would most probably have sufficed for the plant lives without an organic paint coating. Information on the performance of hot dip galvanizing on its own should be presented as a distinguishing feature when selling the successes of duplex, if we are honest in our endeavours to

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accurately justify the use of duplex coating on hot dip galvanizing in specific applications.

5. Finally, some 5 years after responding to Walter's Corner, I still do not see that a commercially viable duplex coating industry has sprung up in South Africa. Whilst I salute a number of pioneering galvanizers in Cape Town for their brave efforts, I believe that we should seek an answer as to why this coating system has not yet taken our project houses by storm?

In the interim I believe that we should nurture the spirit being shown in Cape Town and encourage the sharing of knowledge to parties really interested in developing the duplex coating system on hot dip galvanizing. To those paint manufacturers willing to buy in, we (HDGASA and Hot Dip Galvanizing Today) should give our total support.

The Association wishes to thank Pieter Uys for this article.

NOMINATIONS NOW OPEN

for consideration in the

2011 HOT DIP GALVANIZING AWARDS

Nominations are now open for the 2011 Hot Dip Galvanizing Awards – the winners will be announced at the Gala Evening which is scheduled to be held on Friday 26 August 2011.

Each accepted nomination must comply with the following:

- Each project should have the potential to be used as a case study in the future
- Every accepted submission should have the potential to add to the Association's market development

The nomination deadline is the end of February 2011, a month earlier than usual, allowing the project team ample time to complete the submission. Once your nomination has been accepted, you will be required to complete the submission.

The nomination form is available for download on the Association's website www.hdgasa.org.za or via e-mail - hdgasa@icon.co.za

KINDLY CONTACT THE ASSOCIATION FOR FURTHER DETAILS

HOT DIP GALVANIZING MEMBERS

GALVANIZER	LOCATION	TEL. NO	SPIN	NO. OF LINES	BATH SIZES (L x W x D) (m)
GAUTENG					
ArcelorMittal South Africa	Vanderbijlpark	016 889-9111		3	Sheet galvanizer
Armco Galvanizers	Isando	011 974-8511		1	13.2m x 1.5m x 2.2m
Armco Galvanizers – Dunswart	Dunswart	011 914-3512	●	3	5.2m x 1.2m x 2.0m 3.0m x 1.0m x 1.5m 2.0m x 1.0m x 1.5m
Babcock Nthuthuko Powerlines (Pty) Ltd	Nigel	011 739-8200		1	12.0m x 1.4m x 1.8m
Cape Gate (Pty) Ltd	Vanderbijlpark	016 980-2270		#	Wire galvanizer
DB Thermal SA (Pty) Ltd	Nigel	011 814-6460		In-line	16.0m x 1.0m x 1.0m
Galvadip (Pty) Ltd	Waltloo	012 803-5168		2	7.2m x 1.7m x 2.2m 7.0m x 1.5m x 2.5m
Galvrite Galvanising (Pty) Ltd	Randfontein	011 693-5825		1	6.5m x 1.3m x 2.0m
Galvspin Galvanizers cc	Boksburg North	011 894-1426	●	2	2.0m x 1.2m x 1.5m 1.5m x 1.0 x 1.5m
GEA Air Cooled Systems	Germiston	011 861-1571		In-line	11.5m x 1.0m x 1.0m
Lianru Galvanisers cc	Nigel	011 814-8658		2	7.2m x 1.3m x 1.6m 4.5m x 1.3m x 1.6m
Macsteel Tube & Pipe	Boksburg	011 897-2194		In-line	13.5m x 1.6m x 2.4m
Pro-Tech Galvanizers (Pty) Ltd	Nigel	011-814-4292	●	2	3.2m x 1.1m x 1.5m 3.0m x 1.1m x 1.2m
Robor Galvanizers (Pty) Ltd	Germiston	011 876-2900		3 Tube	14.0m x 1.35m x 2.5m 10.0m x 2.0m x 4.0m Dia 42mm to 114mm max tube length 6.7m
Robor Tube	Elandsfontein	011 971-1600		1	Tube & pipe galvanizer
Supergalv	Alrode	011-908-3411		1	6.0m x 1.2m x 1.8m
NORTH WEST					
Andrag Agrico	Lichtenburg	018 632-7260		#	In-line galvanizer
FREE STATE					
Harrismith Galvanizing & Steel Profile	Harrismith	058 623-2765		2	12.0m x 1.2m x 2.5m 4.5m x 1.3m x 2.5m
WESTERN CAPE					
Advanced Galvanising Corp.	Bellville	021 951-6242		1	8.0m x 1.5m x 3.0m
Cape Galvanising (Pty) Ltd	Parowvalley	021 931-7224		1	14.0m x 1.6m x 2.6m
Galvatech (Pty) Ltd	Bellville	021 951-1211		1	7.5m x 1.5m x 2.6m
Helderberg Galvanizing	Strand	021 845-4500		1	5.5m x 0.8m x 2.4m
Pro-Galv cc	Stikland	021 945-1803		1	7.2m x 1.3m x 2.6m
South Cape Galvanizing (Pty) Ltd	George Industria	044 884-0882		1	3.7m x 0.94m x 2.3m
EASTERN CAPE					
Galvanising Techniques cc	Port Elizabeth	041 486-1432		1	12.0m x 1.3m x 2.3m
Galvaspin (Pty) Ltd	Port Elizabeth	041 451-1947	●	1	3.0m x 1.2m x 1.8m
Morhot (Pty) Ltd	East London	043 763-1143		1	7.0m x 1.5m x 2.5m
KWAZULU/NATAL					
A&A Galvanisers	Pietermaritzburg	033 387-5783	●	1	3.3m x 0.9m x 1.9m
Bay Galvanisers	Richards Bay	035 751-1942		1	5.0m x 1.2m x 2.5m
Phoenix Galvanizing (Pty) Ltd	Phoenix	031 500-1607	●	2	14.0m x 1.4m x 2.5m 3.0m x 1.2m x 1.2m
Pinetown Galvanizing	Pinetown	031 700-5599		1	9.0m x 1.2m x 3.0m
Voigt & Willecke (Pty) Ltd	Durban	031 902-2248		1	14.0m x 1.3m x 2.5m

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

Note:

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

CONSISTENTLY DELIVERING SUPERIOR QUALITY GALVANIZED PRODUCTS.

ARMCO SUPERLITE
GALVANIZING

Our Isando plant can accommodate heavy steel structures with our 13,2 metre kettle and improved cranage and loading facilities. Our Dunswart plant specialises in small, difficult-to-handle items with centrifugal and jobbing work handled efficiently with three production lines. Both plants offer an in-house transport facility, a high level of expertise and quick turn around time.

The company has it's own SANS 121 2000 ISO 1461 accredited Hot Dip Galvanizing plants. And is listed under the SABS ISO 9001 scheme.

Isando + 27 11 974 85 11 • Dunswart + 27 11 914 3512 • www.armco.co.za

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