2010 Volume 7 Issue 2

HOT DIP GALVANIZING TODAY

HOT DIP GALVANIZERS ASSOCIATION Southern Africa

43

Featuring:

S355 tubing, hot dip galvanized sign gantries, fog harvesting

Case Study on heat exchangers

Stephen's Corner – "It only works when you don't need it!"

Rooi Els House – a comprehensive duplex coating system

On the Couch with Dr Hennie de Clercq, Bob's Banter, Members News, etc.

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Front Cover: *A kaleidoscope of photos showing an enthusiastic cyclist's balcony balustrade railing, tubes and pipes, masts and poles, as well as a heat exchanger being hot dip galvanized.*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment

Lifecycle cost analysis gives a more comprehensive evaluation of true costs

Employ lifecycle cost analysis, in preference to initial costs, as it provides a complete picture of the true long term performance characteristics of products used on capital projects.

Contracts for supply of hot dip galvanized structural steel and fasteners on projects are often awarded based purely on the initial costs. However, as a result of different corrosion control methods available, initial costs do not reflect the costs of maintaining the products over the lifecycle of projects. Products initially may appear to be more expensive, but once the life cycle performance is included, substantial savings are available to the end user or project owner. Maintenance free performance over the life of a project has been shown to be of significant importance in times of economic uncertainty.

Foreign subsidised landed imports may well reflect an initial price advantage, but when one includes logistics and perhaps the more important impact on how such imports affect the growth of local industry, surely this aspect warrants greater attention to a more detailed analysis when awarding tenders. There is a relationship that equates to; "greater number of imports results in greater job loses". State bodies responsible for infrastructural projects are under pressure to keep costs down and therefore often only consider initial costs. Factors such as product lifecycles, maintenance and logistical costs, impact on the economics of projects and can be extended to the important question of job creation. Such factors should be considered as an integral part of project evaluations.

Application of sound corrosion control systems, steel structures last between three to five times longer, gives real meaning to the term of "sustainable development". Conservation of our natural material and human resources, together with environmental impact, will escalate in the years to come.

Bob Wilmot

Note from the Editor

Having run a number of Comrades Marathons over the years starting in 1972, at the back of my mind I always wanted to run a 'free one'. On the 30th May, I managed to complete number 26! While trail running for me has of late taken preference, the Comrades Marathon for what it represents to both runners and bystanders will always remain special to me! The initial challenge at age 22 was daunting to say the least but like life, once one has physically and mentally prepared, the race may have its up's and down's but is for most able bodied persons, relatively easy. Running another one, well...?

Recently, I chatted to a friend of mine who on behalf of the client was given the task of acting as a third party inspector/facilitator/expeditor to our industry. Briefly his roles were:

- Assist at the steelwork contractor where necessary to ensure that all components were correctly designed and fabricated to ensure quality hot dip galvanizing.
- Ensure that components were correctly loaded / unloaded and transported according to the planned delivery dates.
- Inspect the finished galvanized components for conformity and ensure timeous delivery to site.
- Ensure that laid down areas on site could easily accommodate correct stacking.
- Where necessary, ensure that the correct coating repair material/procedure was used.

Conclusion – a successful project! If you are interested in something like this, contact us.

Magazine No. 42 was supported by a few adverts that displayed electroplated components, while these companies do supply these they also supply hot dip galvanized components, *we are therefore not encouraging the use of the former coating* for external applications.

Our features for this issue include, the launch of S355 tube, in **Tubes and Pipes**, hot dip galvanized sign gantries in **Mast and Poles**, fog harvesting in **Water Storage**, a case study in **Heat Exchangers and Cooling Fans**.

Prof. Stephen Yeomans starts his "Corner" **"It only works when you don't need it!"** with some supporting articles on hot dip galvanized rebar.

The **Duplex** feature highlights the corrosion protection of some 70 tons of structural steel that because of the initial holes required in the tubular steel, resulted in about 1 600kg of drill swarf, for a house in Rooi Els.

"On the couch" features Dr Hennie de Clercq, Executive Director of SAISC.

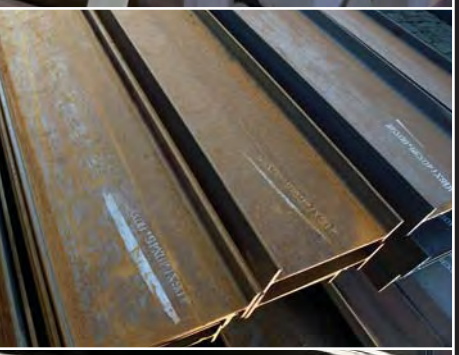
Education and Training, includes our certificated coating inspectors course and highlights two plant tours by architectural students and a consulting engineering company.

Other regular articles include, **Bob's Banter**, where Bob Andrew chats about **"The logic of partnerships"** and **Members News**.

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

Enjoy the "*magazinc*".

Terry Smith



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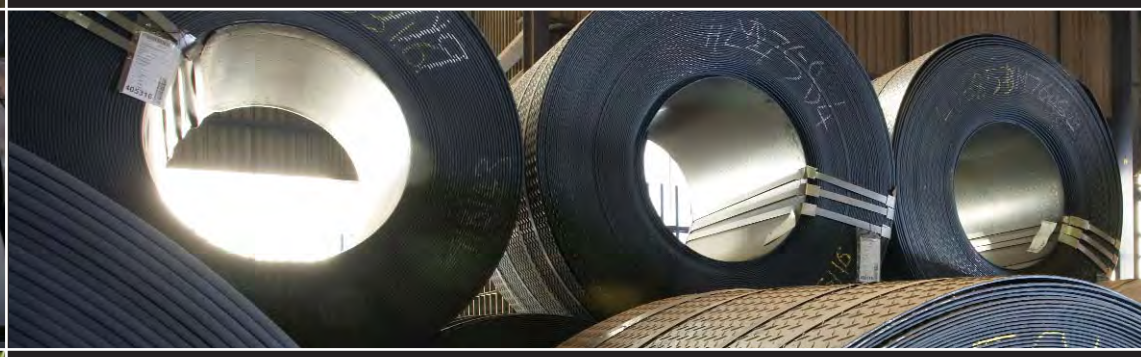

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Lula and Cable-Lock Pipe: A dual force at Dilokong Chrome Mine

Lula Pipe and Cable-Lock Pipe make for quick and easy installation of a steel pipe system. Rated at 25 bar, this socket and spigot steel pipe system provides the plastic pipe socketing system's efficiency, with the strength of steel.

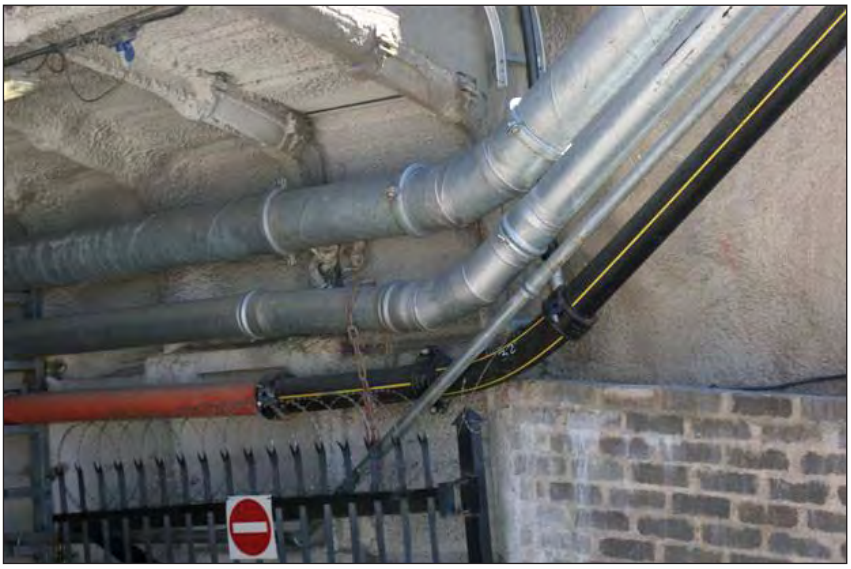
The latest showcase for both Lula Pipe and Cable-Lock Pipe is a four-tier project at the Hannekom Shaft of ASA Metals' Dilokong Mine in Burgersfort, in the Limpopo province, where over three kilometres of a combination of Lula and Cable-Lock Pipe have been installed.

A 1 350m pipe line using 200mm Cable-Lock Pipe was installed to be used for a compressed air column, running from the surface to the bottom of the mine. This vertical air column at the height of its depth is in operation some 330m below the surface.

As well as this, one kilometre of 110mm Lula Pipe has been installed to run from the supply tanks located on the mountain to provide staff facilities and the kitchen area with water. This line makes use of Lula bends along the line and incorporates ducts and road crossings.

Another separate 500m line of 110mm Lula Pipe was installed underground in an existing raise, which serves to supply service water from level 1 to level 2. This line supplies between 200 and 250 cubic metres of water per day, and the water pressure this line is subjected to is between 12 and 16 bar. As Lula Pipe is rated 25 bar and tested to 50 bar, it more than copes with this water pressure.

Further to this, another 250m of 200mm Cable-Lock Pipe was installed at Dilokong Mine to move service water from point A to point B. Cable-Lock Pipe is a further innovation on the Lula Pipe in that it too makes use of the socketing system in a steel pipe, but with an aperture in the socket end into which a cable is inserted providing a positive locking mechanism. This means that not only can Cable-Lock be run along the



surface in the same way that Lula Pipe can be without couplings or nuts and bolts, but thrust blocks are no longer necessary. This makes for a very cost effective steel pipe system, which was seen in the case of Dilokong Chrome Mine, who enjoyed an on average between 20 and 30 percent cost saving compared to alternative piping systems, taking into account pipe supply and installation costs.

Under the leadership of mining Resident Engineer Gerhard Fourie, Dilokong Chrome Mine has increased in production from 20 000 tonnes per month in 2005 to 55 000 tonnes per month to date, a 275 percent increase in efficiency. For this project, Lula and Cable-Lock Pipe were supplied as hot dip galvanized to SANS 121 (ISO 1461) and installed by Grinaker Mining and supplied by Value Steel.

Should you require any further information regarding either Lula or Cable-Lock Pipe, please visit the EPNS *Engineering website at www.epns.co.za or contact area suppliers Value Steel on* (013) 214 7233.

The development of S355 tube

YS300 history

YS300 was the first structural tube steel grade to be developed in South Africa and was introduced to the market in 1997. This development started with the 300WA analysis as a base. Due to welding problems, it had to be redesigned to a leaner analysis. From a low base, the demand for this product grew to approximately 75 000 ton in 2008.

Why change?

The focus in the entire steel industry became 'stronger and lighter'. During the same period, the truck and trailer industry managed to reduce the mass of trailers by almost 50% by moving to high strength steels. The next to follow was structural steels to move from 300MPa to 350MPa. In 2008 the 'Red Book' was changed to specify S355 as the base design grade. In 2009, SANS also 'adopted' the Euro Norm structural specifications (EN 10025). Thus only the tube steel grade remained on 300MPa.

The development process

The first trial coils were based on the S355 structural analysis (tensile 470MPa min). During the tube making trials, it was found that the product had good welding and forming properties, but that the strength was too high. The product was therefore re-designed based on the EN 10219 specification (tensile 450MPa min). On completion of the second trials, the entire industry was convinced that the product was a huge success.

Product comparison

Properties	YS300	S355 Tube
Min Yield strength	300MPa	355MPa
Chemistry	Carbon-Manganese	Micro alloyed
Hot Dip Galvanizing	Low Si; 0.03%	Si = 0.15 – 0.25%
	0.025%	Although P is specified as 0.025% max but in most incidences will be a max of 0.012%.
Carbon equivalent	±0.34	±0.20
Weldability	Acceptable	Good
Formability	Acceptable	Good
Toughness	Good	Excellent

Conclusion

ArcelorMittal is proud to be part of the development of this steel for the tube industry. The S355 tube specification is definitely an improvement on the YS300 product in many ways. This product is now not only aligned with the rest of the structural and plate steel grades, but also conforms to international standards. YS300 tube was phased out at the end of February 2010. As from March 2010, only S355 tube will be available.

Jan Kotzé.

Recently launched Grade 355 tubes – a compelling engineering solution for many applications

Grade 355 tubes, also commonly known as structural hollow sections, were launched in February in Cape Town, Durban and Johannesburg. Previously Grade 300 Tube, launched in June 1997, was available. The launch was a joint venture between the Association of Steel Tube and Pipe Manufacturers of South Africa and the Southern African Institute of Steel Construction. Engineers can now take advantage of an increased minimum yield stress of 355MPa and an ultimate yield tensile stress of 450MPa for designs.

Grade 355 Tube will enhance the existing benefits of structural hollow sections. Tubes will now be able to compete on a more equal footing with other steel sections as well as competing with other construction materials.

Structural benefits

Structural benefits of tubes are apparent when one compares various different profiles required to resist the same compressive loads. In *Table* 1 below various different profiles are compared in resisting a compressive load of 800kN and an effective length (kL) of 3.0m. In the comparison the circular hollow section is lightest of all, followed by the square hollow section. The circular hollow section is 46% lighter than the 152 x 152 x 37 universal column. In members subject to mainly compression mass savings of up to 55% by mass are possible when compared to other profiles.

In simple terms the material in a tube is ideally positioned far away from the centre of gravity of the profile and hence increases the radius of gyration. This reduces the slenderness ratio thus increasing the load carrying capacity of the cross– section. This material distribution results in a typically higher second moment of area with a higher section modulus. Another advantage of tubes is that the closed section increases the St. Venant torsion constant (j) hence increasing the torsional resistance of the member. This results in high flexural stiffness in all directions combined with a high torsional stiffness.

Table 2 is a comparison between different profiles where a St. Venant torsion constant of 1.7 x 10^6mm^4 is required to resist a torsion load

In general, columns and beams made from tubes do not need to be checked for torsional-flexural buckling if they fall within the limits of the slenderness ratio or when the height to breadth of these sections does not exceed 2 to 1.

Another factor often overlooked is that because the tubular structure is lighter and therefore more efficient, a smaller foundation may result, with the potential of reducing costs. This is especially applicable where poor foundation materials are encountered.

These structural efficiencies also give the architect and engineer options of reducing the number of columns in the structure. This effectively provides the developer with more usable space thus optimising the area under cover.

Low mass to strength ratio

The lower mass of the structure often provides the engineer with a competitive engineering solution. The lighter, yet stiffer structural members simplify the erection as longer spans can be pre-fabricated, thus increasing the speed of erection and decreasing the cost of erection.

From an environmental aspect less material is used without affecting the functionality of the structure. This is particularly important for long–span girders and trusses, where hot rolled section construction would require lateral stabilising during lifting.

Corrosion design

The smooth exterior presented by hollow section members together with the absence of gussets, re-entrant corners, inaccessible surfaces (as in double angle members) bolt heads

RELATIVE MASSES OF STRUTS					
C_r = 800 kN		kL 3.0m			
	Profile	Radius of Gyration min (mm)	Mass Kg/m	Resistance C_f (kN)	Mass ratio
○	CHS 177.8 x 6.0	60.8	25.4	836	1.00
□	SHS 150.0 x 6.0	58.4	27.2	850	1.07
L	200 x 200 x 16 Angle	39.4	48.5	1140	1.91
I	152 x 152 x 37 Universal Column	38.7	37.0	860	1.46
⊢	100 x 100 x 10 Star Angles Strut	45.0	35.6	810	1.40
⅄	150 x 90 x 12 Back-to-back Angles	36.9	43.2	833	1.70

Table 1.

RELATIVE TORSIONAL STRENGTH				
	Profile	J (10^6 mm^4)	Mass	Mass ratio
○	CHS 88.9 x 4.0	1.93	8.38	1.0
□	SHS 75 x 5.0	1.77	11.1	1.3
L	200 x 200 x 24 Angle	1.80	71.1	8.5
I	533 x 210 x 122 I-Section	1.81	122.0	14.6
H	254 x 254 x 107 H-Section	1.75	107.0	12.8

Table 2.

Photos above show S355 tube (open on both ends) hot dip galvanized at 450°C.

and nuts etc. can result in a major enhancement of the ease with which corrosion resistance design may be achieved. Particular benefits can be gained on structures where access is difficult for maintenance painting such as footbridges or sign structures over motorways.

Galvanizing of tube

The steel has been designed to be galvanizing friendly. The Silicon content was reduced from the original maximum 0.55 to the range 0.15 to 0.25, an internationally well recognised range that will produce good galvanizing. This Silicon range now will be the same as that the currently available grade 355 steel plate and conventional long products, hence aesthetics will be compatible. Previously, grade 300 steel was aluminum killed.

The phosphorus maximum content is also controlled. Statistical data received to date has measured a maximum of phosphorus of 0.020% and the average of 0.012%*.

continued on page 8...

RELATIVE PAINT AREAS			
		mm^2/m	Area ratio
○	CHS 177.8 x 6.0	559	1.00
□	SHS 150.0 x 6.0	600	1.07
L	200 x 200 x 16 Angle	800	1.43
I	152 x 152 x 37 Universal Column	912	1.63
⊥	100 x 100 x 10 Star Angles Strut	800	1.43
⊥L	150 x 90 x 12 Back-to-back Angles	960	1.72

Table 3.

The trials were done in on an automated pipe galvanizing line and in open dipped galvanized. The above photographs were taken of tube that was open dip galvanized.

Concrete filled tubes – an interesting option

Tubes offer an option to increase their load carrying capacity by filling them with concrete. This capacity can further be increased by the addition of reinforcement. Not only does the additional strength come with little extra cost, the fire resistance is increased significantly. Internationally this method has found favour with columns in high rise construction.

Guidance with regard of designing of concrete filled hollow sections is comprehensively covered in SANS 10162 Part 1.

Aesthetical attractive appearance

Aesthetically pleasing solutions are possible using tubular construction. This is derived not only from the simple outline of the profiles themselves, but also from the absence of such items as gussets, battens, lacing, sub-bracing, lateral ties, bolts and the like. Curving of members is easily facilitated with circular hollow sections, and to a lesser degree with square and rectangular hollow sections. Please be reminded that thicker profiles are less likely to suffer from secondary distortion during curving.

RELATIVE WIND RESISTANCE					
		C_f*		C_f x b	Wind resistance ratio
1→○	CHS 177.8 x 6.0	1	1.20	213	1.00
1→□ 2↗	SHS 150.0 x 6.0	1 2	1.65 1.60	248 339	1.16 1.59
1→L 2↗	200 x 200 x 16 Angle	1 2	2.00 1.80	240 509	1.12 2.39
1→I 2↗	152 x 152 x 37 Universal Column	1 2	2.10 1.80	319 273	1.50 1.28
1→⊥ 2↗	100 x 100 x 10 Star Angles Strut	1 2	1.75 1.62	420 275	1.64 1.07
1→⊥L 2↗	150 x 90 x 12 Back-to-back Angles	1 2	1.50 1.60	180 384	1.05 1.35

* Based on Tables 15 and 22 of the SABS 0160-1989.

Table 4.

Other benefits

Reduced paint areas, refer to *Table* 3, and reduced wind resistance, refer to *Table* 4.

In *Table* 3 the paint areas are compared for the above previous design example. The circular hollow section has 43% less surface area than the equivalent star angle strut configuration resisting the same load. The relative ease with which painting maintenance can be done is also apparent when one studies the various member configurations.

Similarly *Table* 4 compares the wind force for the same design example. A star angle strut attracts 64% more force than the equivalent circular hollow section.

Grade 355 tube size range

In *Table* 5 the size range is shown. Stocking of the sizes varies from manufacturer to manufacturer.

SIZE RANGE OF 355MPa STEEL STRUCTURAL HOLLOW SECTIONS IN SOUTH AFRICA

Rounds

Outside diameter (mm)	Wall thickness t (mm)								
	2.5	3	3.5	4	4.5	5	6	8	10	12
48.3 SA	■	■	■	■						
60.3 SA	■	■	■	■						
63.5 SA	■	■	■	■						
76.2 SA	■	■	■	■	■	■				
88.9 SA	■	■	■	■	■	■				
101.6 SA	■	■	■	■	■	■				
114.3 SA	■	■	■	■	■	■				
127.0 SA	■	■	■	■	■	■				
139.7 SA		■	■	■	■	■				
152.4 SA		■	■	■	■	■				
165.1 SA		■	■	■	■	■				
177.8 SA			■	■	■	■				
193.7 SA			■	■	■	■				
219.1 SA			■	■	■	■				
273.1 SA							■	■	■	■
323.9 SA							■	■	■	■
355.6 SA							■	■	■	■
406.4 SA							■	■	■	■
457.0 SA							■	■	■	■
508.0 SA							■	■	■	■

Rectangles

Size dxh (mm)	Wall thickness t (mm)								
	2.5	3	3.5	4	4.5	5	6	8	10
50 x 25 SA	■	■	■	■					
60 x 40 SA	■	■	■	■					
76 x 38 SA	■	■	■	■					
80 x 40 SA	■	■	■	■					
76 x 50 SA	■	■	■	■	■	■			
100 x 50 SA	■	■	■	■	■	■			
120 x 60 SA		■	■	■	■	■	■		
160 x 80 SA				■	■	■	■	■	■
200 x 100 SA				■	■	■	■	■	■
200 x150 SA				■	■	■	■	■	■
250 x 100 SA				■	■	■	■	■	■
300 x 140 SA				■	■	■	■	■	■
320 x 200 SA				■	■	■	■	■	■
340 x 180 SA				■	■	■	■	■	■

Squares

Size dxh (mm)	Wall thickness t (mm)								
	2.5	3	3.5	4	5	5	6	8	10
38 x 38 SA	■	■	■	■					
50 x 50 SA	■	■	■	■					
60 x 60 SA	■	■	■	■	■				
75 x 75 SA	■	■	■	■	■				
80 x 80 SA	■	■	■	■	■				
100 x 100 SA	■	■	■	■	■				
120 x 120 SA		■	■	■	■				
150 x 150 SA				■	■		■	■	■
175 x 175 SA				■	■		■	■	■
195 x 195 SA							■	■	■
220 x 220 SA							■	■	■
260 x 260 SA							■	■	■
285 x 285 SA								■	■

Table 5.

Technological developments in processing of steel

Modern high definition plasma and laser profiling machines have arrived in South Africa, simplifying the assembly of connecting profiles radically. This, ever developing, technology makes the profiling of tube intersection simple. The machinery provides the fabricator with a clean ready to assemble component that can be simply welded together with ease. The machines not only profile and/or make slots at the ends of the members but can cut any shapes that may be required along the length of the member.

Plasma and laser machines are supplied with either a 2D head or a 3D head. The 3D head is typically required for thicker material where weld preparation is required at the end of the tube.

Conclusion – economies of tubular structures

We have presented a strong case for using hollow sections in steel structures. The argument against their more general utilisation is of course based on cost. There is no debate that the purchase price per ton of hollow sections is higher than that of hot rolled conventional long sections. The previously often quoted "high labour costs" have significantly reduced but will still be higher than for hot rolled labour. But these increases will in many instances be more than offset by the lower mass of tube profiles needed when compared with the equivalent hot rolled profile solution.

The case of members subject to mainly to compression forces, that is columns and bracing, tubular construction, is well documented and surely will be cheaper in tube construction.

However for other structural components, in the final analysis, if all the aspects are carefully considered and properly assessed, in a great many applications tubular construction will be very competitive. Is it not time for you to do the exercise on your next project?

By Franco P. Mordini – Robor Market Development Engineer and Chairman of the Technical Committee of the Association of Steel Tube and Pipe Manufacturers of South Africa.

Editor's comment

**While the phosphorus content in terms of EN 10025-2:2004 is maximized at 0.025% as reported, the phosphorus has statistically not exceeded 0.02% in the production of S355 thus far. However, when designing / fabricating tubular elements with S355 steel, ensure that optimally sized vent, fill and drainage holes are adherred to for quality hot dip galvanizing. The S355 tubular steel type lends itself to Architectural hot dip galvanizing as the surface finish and appearance is generally more predictable and aesthetically acceptable".*

Sign gantries on R300 hot dip galvanized!

Following years of consistent promotion by the HDGASA, SANRAL decided to update the design of their sign gantries and now allows hot dip galvanizing to be specified in selected locations such as the R300 in Cape Town which is in a corrosive climate.

The sign gantry shown *photos* 1 - 3 was hot dip galvanized and erected some 30 odd years ago in Johannesburg. The residual coating readings taken recently are still in excess of 250µm, providing a conservative, predictable future life in this environment of in excess of another 30 to 40 years!

The HDGASA received a call from Gerrit Visser of SSI, enquiring as to the likely service free life of hot dip galvanizing on the R300 in Cape Town. After hearing that due to the normal coating thickness achieved with this type of structure, the service life was likely to be in excess of 50 years the decision favouring hot dip galvanizing was made.

DLE was appointed as the steelwork fabricator and invited the HDGASA to comment regarding any additional design requirements over and above that indicated on the drawings from SANRAL for successful hot dip galvanizing.

The steel had at this moment in time unfortunately already been ordered and while it was specified as a grade S355 in accordance with EN 10025:2004, the chemical analysis of the steel was unknown to the HDGASA.

The gantries are fabricated from 4 plates that are squared and welded together by a number of diaphragm plates positioned along the length of the gantry (*photos* 4 *and* 5).

While fill and drainage holes/snipes, etc. for the accessibility of molten zinc were already documented in the

Photo 1.

Photo 2.

Photo 3.


Photo 4.


Photo 5.


Photo 6.


Photo 7.


Photo 8

Photo 9.

Photo 10.

Photo 11.

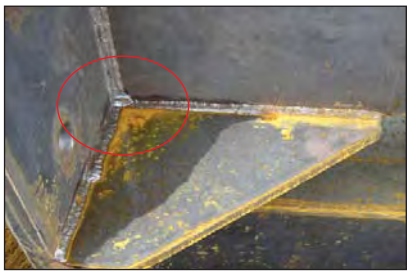


Photo 12.

Photo 13.

Photo 14.

drawings, several additional and larger holes for this purpose were added or increased in size.

While the base plate had a central hole to allow the passage of most of the molten zinc, two additional diagonal holes were added to ensure drainage at the corners. However, these two additional holes proved to be inadequate to allow the molten zinc to exit timeously and subsequently two further holes were added to ensure rapid drainage of the molten zinc (*photos* 6 - 8).

Before closing up of the structure (*see photos* 4 *and* 5), the selected galvanizer was invited to inspect the fill and drainage holes in the structure.

Many snipes were too small (unfortunately almost closed up by welding), some on the base plate were non-existent.
Depending on the size and position of the gusset plate on the component, the galvanizer might be able to manipulate the component in molten zinc to avoid air pockets, build-ups of zinc, etc. but this takes up processing time and immersion times may be extended, which together with reactive steel can result in undesirable thicker than necessary coatings (*photos* 9 - 12).

As no galvanizing was required on the threaded studs a mask was used to prevent this happening. However, effective control by the applicator is necessary to ensure that the mask is not applied to surfaces that are required to be galvanized (*photos* 13 *and* 14).

continued on page 12...


Photo 15.

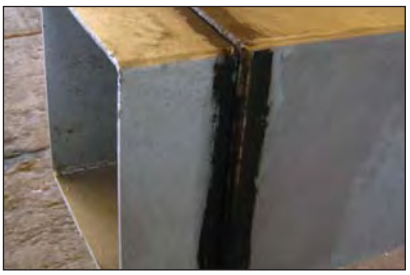


Photo 16.


Photo 17.


Photo 18.


Photo 19.

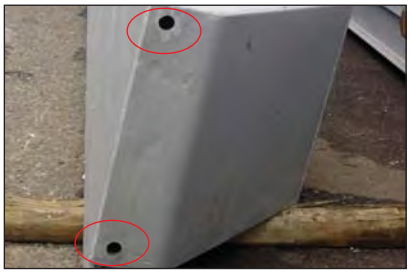


Photo 20.

A mask was also used to exclude the existence of zinc, where components that were too large for galvanizing or transport purposes, were to be welded on site. The mask can be easily applied and removed after galvanizing, ensuring an uncoated surface, essential for successful welding after hot dip galvanizing (*photos* 15 *and* 16).

To prevent the use of only chains, which is usual for heavy components such as these, lifting lugs were added for convenience at the galvanizer and when handling on site (*photos* 17 *and* 18).

Over and above the design, additional fill/drainage holes were added both at the internal haunch plate and at the end plate on the cantilever gantries (*photos* 19 *and* 20).

Where lifting lugs were not available, the heavy components were handled using chains attached to cranes or maneuvered into position at the galvanizer by forklifts (*photos* 8 *and* 21).

Services conduits built-in or fixed externally galvanized very well, providing the designed amount of cable accessibility (*photos* 22 *and* 23).

Due to the reactivity of the steel as well as the dipping difficulty with the majority of the components longer immersion times were inevitable resulting in coating thicknesses in excess of 200µm (*photos* 24 *and* 25).

In extreme cases where longer immersion times were unavoidable, coating thickness of in excess of 600µm was achieved (*photos* 26 *and* 27).

In spite of the obvious advantage of a thicker coating providing a proportionally longer maintenance free life, the coating can be brittle and when mechanically damaged may flake off.

Where this does happen usually a residual iron/zinc alloy layer of between 20 and 60µm of zinc remains. Any flaking of the galvanized layer was


Photo 21.


Photo 22.


Photo 23.

Photo 24.

Photo 25.

Photo 26.

Photo 27.

Photo 28.

suitably repaired using zinc metal spraying of similar coating thickness (*photos* 28 *and* 29).

Where thicker coatings exist they are often dull grey or mottled in appearance, indicating the presence of extensive iron/zinc alloy phase growth, caused by steels with reactive levels of silicon and/or higher amounts of phosphorus (*photo* 30).

The gantries were transported to site and welded together by DLE. The damaged coating at the welds were

Photo 29.

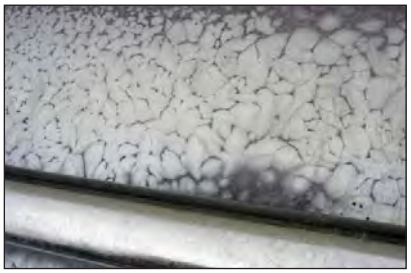


Photo 30.

then appropriately repaired and after taking occupation of the road, the gantries were finally lifted into position (*photos* 31 - 34).

Conclusion and recommendations

- While thicker hot dip galvanized coatings will provide proportionally

continued on page 14...

longer service free lives, they are easily damaged when mechanically handled.

It is therefore recommended that in order to achieve good quality hot dip galvanized coatings in any future sign gantries, greater attention should be levied at the following:

- While making use of a graded steel such as S355 to EN 10025-2:2004 for mechanical strength, a chemical analysis certificate indicating the chemical analysis of the steel, particularly the silicon and phosphorus content,would be advisable.
- For general hot dip galvanizing purposes, silicon should ideally be limited to 0,15 to 0,25% and the phosphorus to 0,02% or less.
- Where possible from a structural perspective, vent, fill and drainage holes, including diaphragm snipes should ideally be increased to greater than that required by our design requirements applicable for general tubular components. This is necessary to facilitate the passage of molten zinc past each and every diaphragm plate, including haunch plates (*photos* 35 *and* 36).
- Procuring the correct type of steel and initiating these design and fabrication additions, will extensively reduce the time of immersion in molten zinc, ensuring quality hot dip galvanizing with a coating thickness reasonably in excess of the requirements of SANS 121 (ISO 1461), is achieved.

PROPOSED FEATURES FOR 2010

August/September (No 44):
• Architectural hot dip galvanizing
• Cable ladders and trays

November/December (No 45):
• The world of hot dip galvanizing around us • Sustainability of the industry

NOTE: FEATURES MAY BE SUBJECT TO CHANGE

Photo 31.

Photo 32.

Photo 33.

Photo 34.

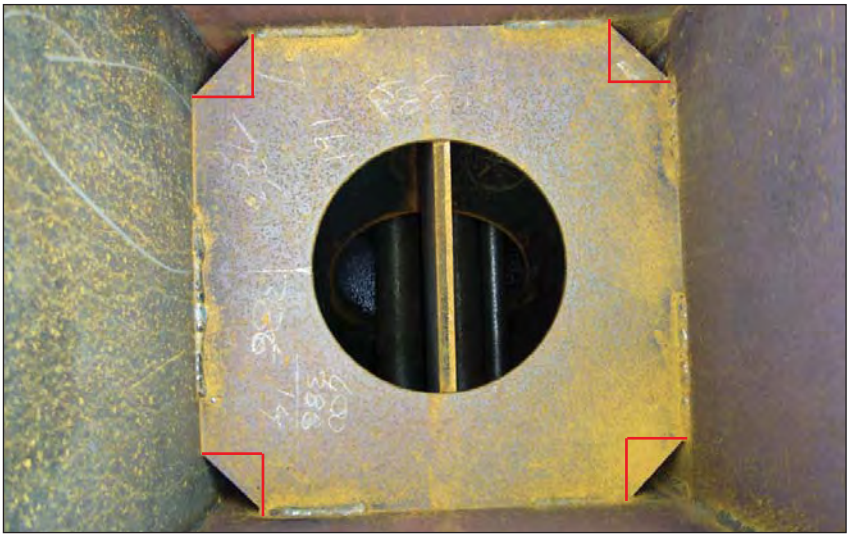


Photo 35. Increase snipe by cut outs as shown.

Photo 36. Increase vent, fill and drainage holes to as big as possible at the haunch plate.

IPM projects and emphasis on straightening after hot dip galvanizing

Straightening

IPM is one of the biggest manufacturers and suppliers of steel street light poles and outreach arms/ brackets in South Africa. The company has a certified ISO 9001:8000 quality management system and in accordance with this system all products are inspected and checked prior to and after hot dip galvanizing to make sure that they comply to the general hot dip galvanizing standard of SANS 121 (ISO 1461).

All outreaches and brackets are subjected to a special process where after all items will comply to IPM's specific standards and processes. This method speeds up all production processes and is done after galvanizing and has been a proven success for more than 23 years.

This innovative process is vital to the entire success of street light poles/brackets to IPM's customers and will also assist contractors on site to work without any delays.

At the galvanizer

Prior to hot dip galvanizing, depending on the pole and outreach arm length a limited number of poles will be mounted on a jig or flight bar. The components are jigged at an angle (to the floor) with the largest diameter of the tube at the lowest point.

The general galvanizing process entails the slow removal of the components at the optimum angle from the molten zinc, ensuring (because of the unique design) complete removal of all excess zinc from the inside of the poles. When the poles are delivered back to IPM's premises, every single pole is inspected and checked for conformity.

During manufacturing and hot dip galvanizing all poles will bend to some degree. IPM is equipped to straighten these poles prior to bundling and despatch. This will ensure poles to be as straight and true as an arrow.

IPM – IN POLE POSITION FOR THE FUTURE

Terry's comment

"Recently I was requested to inspect and evaluate a case where hot dip galvanized light poles with double sided outreach arms were seemingly unacceptable due to deformation. These poles and tubes were manufactured to an acceptable drawing that showed no manufacturing tolerances. While we know that when tubes are tightly bent in conformance with the required radii, residual stresses in the material can occur. When these components are hot dip galvanized any residual stresses are likely to exit. (While stress relieving takes place at about 600°C, hot dip galvanizing at 450°C is a semi-stress relieving process) and can result in bending or deformation. I found it strange therefore that no manufacturing tolerances were made available at the time of tender together with the fabrication drawings. The criteria is possibly aligned towards the set lighting intensity on the road surface below and not on the manufacturing tolerances of the pole? Some pole manufacturers that, however, understand the behaviour of hot dip galvanized steel, have developed their own in-house manufacturing tolerances in conformance with the customers perceived needs! See above article. I now find myself mentally aligning the light poles on major roads while driving and many are not 100% aligned! See photo above.

HOT DIP GALVANIZERS ASSOCIATION GOLF DAY 2010

The annual Golf Day of the Association was held at the Glenvista Country Club on Thursday the 11th March 2010.

The winners of this year's Golf Day, with a score of 57, were Nico Schoeman, Stephen van Zyl, Elwyn Steenkamp and Adrian Meyer, hosted by Robor Galvanizers.

With only four teams returning the dreaded Pink Lady, it was a close race to the finish. Well done to the Armco team consisting of Johan van Wyk, Kobus Visser and L. Odendaal for persevering and winning the Pink Lady, which was sponsored by Robor Galvanizers.

Second place was awarded to the team hosted by Robor Galvanizers, consisting of Barry Hodgson, Gordon Gilmer, Jack Siebert and Mike Mamotte.

With a score of 54 and based on a count out, third place was awarded to Philip Botha, Brian Watsin, Johan de Villiers and Tat Greyvenstein of Supergalv.

Fourth place went to the CWI team consisting of Siebies, Jeremy, Pikkie and Gareth.

Nearest the Pin was awarded to Neil Robertson and Steven van Zyl hit the Longest Drive.

Unfortunately a mix up with the score cards led to the incorrect awarding of the Longest Day. In proving one of the laws of golf which states that no matter how bad your last shot was, the worst is yet to come, the correct team, with a score of 29, is Pierre van Rooyen, Grant Ladeiro, Paul Bedford and Ernest Gertenbach of Robor Galvanizers. The Association will ensure that the correct team receives a belated prize for the dubious honour of being the worst players of the day!

Thank you to our sponsors for their contributions, without which we would not be able to hold a Golf Day. The sponsors are: Armco Galvanizers, Bulldog Projects, Cape Gate, DC Steel Construction, EPNS Engineering, Lianru Galvanisers and Robor Galvanizers

To all the players, thank you for attending the day, we hope you all enjoyed yourselves. Enjoy browsing through the photos. Should there be a photograph you would like, please contact the Association on hdgasa@icon.co.za.

Hot dip galvanized air coolers at an apple farm – Case Study

Two hot dip galvanized air condenser coils, supplied by two different companies were installed some 19 and 4 years ago on this apple farm. According to the owner of the apple farm, the hot dip galvanized coating on the former coil was considerably outperforming the latter one.

The Hot Dip Galvanizers Association was requested to investigate and inspect the condition of the two hot dip galvanized condensers. I report as follows:

The front of the condenser air coil 'A' and the top of the 'B' were opened up and revealed the following:

Photos 3 *and* 4 show the condition of the lower tubes in 'A'. The hot dip galvanized coating was regular and uniform as to be expected. There was nothing to be concerned about. However, *photos* 5 - 7 taken of the top tubes in both coils, show that something is locally attacking the tubes.

Photo 8 shows that the product that has caused the premature localised corrosion of the tubing is being deposited by the water sprays situated at the top of the condenser. The hot dip galvanized tubing that is out of the direct line of spraying nozzles is regular and uniform as would be expected.

The corrosion product was removed in several instances and the respective residual coating thickness measured on both sides of the corrosion and then at the corroded spot in between, *see photos* 9 - 12.

First selected area

Photo 9 shows the corrosion product and adjacent surrounding surfaces scraped. *Photo* 10 shows the residual coating thickness (111µm) and *photo* 11 (150µm) to the left and right of the corrosion spot, respectively. *Photo* 12 shows the coating thickness at the spot measured (16.9µm).

continued on page 18...

Photo 1: The 4-year old air condenser (A).

Photo 2: The 19-year old air condenser coil (B).

Photo 3.

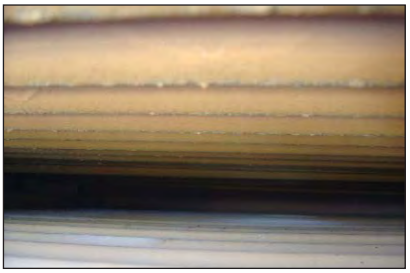


Photo 4.

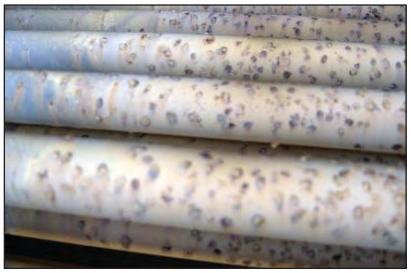


Photo 5.

Photo 6.

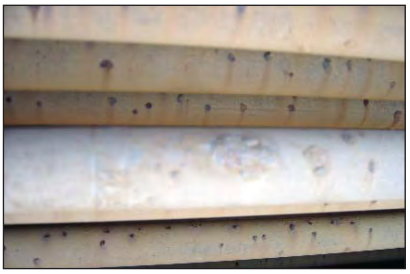


Photo 7.

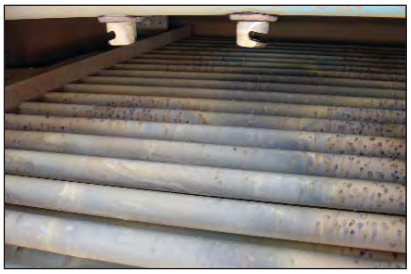


Photo 8.

Photo 9.

Photo 10.

Photo 11.

Photo 12.

Second selected area

Photo 13 shows the corrosion product and adjacent surrounding surfaces scraped. *Photo* 14 shows the residual coating thickness (109µm) and *photo* 15 (114µm) to the left and right of the corrosion spot, respectively.

Photo 16 shows the coating thickness at the spot measured (11.2µm).

In comparison the tubes on the 'B' condenser showed the following:

Photo 17 shows the same discoloration of the tubes due to the corrosion product. *Photo* 18 shows a close up. *Photo* 19 shows the area at

Photo 13.

Photo 14.

Photo 15.

Photo 16.

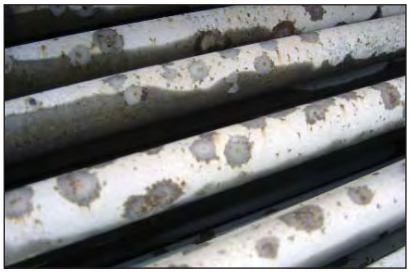


Photo 17.

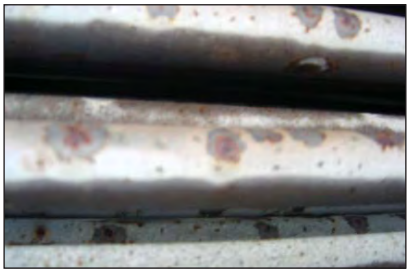


Photo 18.

the corrosion product scraped and *photo* 20 (65.7µm) and *photo* 22 (84.7µm) the residual coating thicknesses left and right of the corrosion product.

P*hoto* 21 shows the residual coating thickness at the corrosion spot (10.1µm).

Concern is sometimes raised that lumps and bumps on the hot dip galvanized coating affects its performance, two such lumps were identified on the tubes and evaluated.

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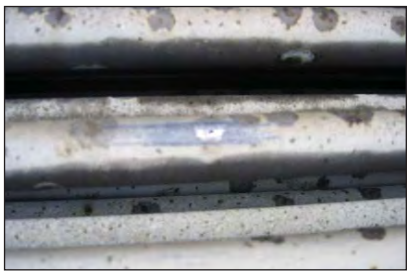

Photo 19.

Photo 20.

Photo 21.

Photo 22.

Photo 23 shows the appearance of the solid zinc lump, *photo* 24 the area scraped off and *photo* 25 the residual coating thickness adjacent to the zinc lump (110µm).

Photos 26 - 28 show the coating thickness on the zinc lump (268, 291 and 394µm respectively).

Conclusion and recommendation

It is clear that some corrosive product currently in the supply water or that was contained in the supply water some time ago has affected the hot dip galvanized coating on both the 'A' as well as the 'B' condenser coil.

It is for this reason that supply water should be immediately analysed for any unusual corrosive products.

While a sample of circulating water was taken and tested, (pH 4.73) and that it was very soft (total hardness 38ppm $CaCO_3$). Hot dip galvanizing is comfortable at pH 6 to 12.5, so at pH 4.73 will be attacked and result in a shorter life.

A scale forming water of above 100ppm of calcium and magnesium as in $CaCO_3$, will considerably extend the life of the hot dip galvanized coating, whereas any reasonable additional chlorides or sulphates will be tolerated.

Information sheet No 6, includes the Corrosivity Index (CI) test as well as the Probability that Corrosion can occur (P). The results provided by the water show that the CI factor is 2.263 whereas it should be <1 to be non-corrosive. P results in a (-8) whereas a P of <-3 or less is unsatisfactory.

The areas of attack by the corrosion product is localised and not uniformly evenly spread over the hot dip galvanized coating on the tubes.

The mechanisim by which hot dip galvanizing protects steel is firstly by way of a slowly corroding barrier (uniform, providing a predictable life in known atmospheres). Secondly, it protects by way of sacrificial protection, where because zinc is electronegative to carbon steel at areas that have been damaged or cut, the zinc coating will preferentially corrode to protect the carbon steel. *See also Information Sheet No 11.*

Therefore, the reason for the premature corrosion of the condenser is due to some corrosive in the supply water or that was in the supply water some time ago and not as a result of the hot dip galvanizing. The supply water as well as the circulating water should be regularly tested and if necessary treated to ensure it is not corrosive to zinc.

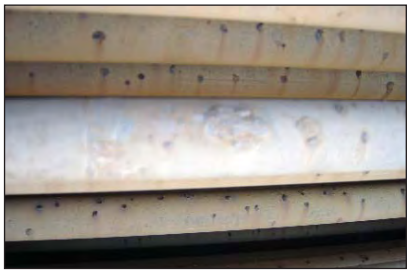

Photo 23.

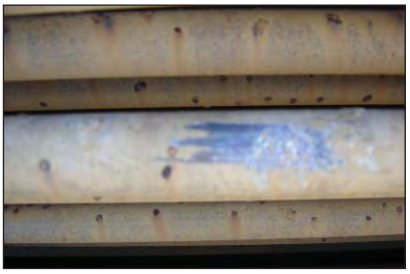

Photo 24.

Photo 25.

Photo 26.

Photo 27.

Photo 28.

Operating and maintenance instructions for typical evaporative condensers and industrial fluid coolers

(In terms of corrosion and specifically hot dip galvanizing)

The following extracts, which have a bearing on the durability of the hot dip galvanized coating used to protect heat exchangers and air condensers have been extracted from one of the major suppliers of these products, "Operating and Maintenance Instructions". While all the Operating and Maintenance instructions are important, the following have particular reference to the durability of the hot dip galvanized coating.

Temperature limits

The standard eliminators can withstand a maximum inlet temperature of 55°C. This temperature should not be exceeded even for short periods or major damage will be caused. (*This requirement is also applicable to the hot dip galvanized coating*).

Seasonal shutdown

Inspect the protective finish on the unit (*includes the side panels and sump*). Clean and repair as required.

During service procedures care must be taken to protect the equipment

Coil

Inspect coil. Any obstructions must be removed. Any corrosion or damage repaired.

Make-up valve

The operating water level should be checked monthly.

Cold water basin and strainer

Approximately every six months (or more frequently if circumstances warrant) the entire cold water basin should be drained, cleaned and flushed with fresh water to remove any slit and sediment which normally collects in the basin during operation. If not removed periodically, this sediment can become corrosive and cause deterioration of the fiberglass finish. When flushing the basin, the strainer should be left in place to prevent particles from re-entering the system. After the sump has been flushed, the strainer should be removed, cleaned and replaced before re-filling the basin with fresh water.

Corrosion protection

The heat transfer coil section is hot dip galvanized after fabrication. Other sheet metal parts are manufactured from continuous hot dip galvanized coil (Z600) and are painted with an appropriate paint system.

The units should be inspected annually. Inspect the complete unit for any damage to the protective coatings. Affected areas should be appropriately repaired.

Water treatment

To control the increasing concentration of the dissolved solids as a result of the evaporation of recirculated water, a water treatment program is required. In many cases a simple bleed-off is adequate for control of scale and corrosion but biological contamination can only be controlled through the use of biocides. The chemicals must be compatible with galvanized steel as well as all other materials used in the system.

Consult a competent water treatment supplier.

Batch feeding of chemicals is not recommended and water quality should be maintained within the guidelines as set out below:

- *p*H: 7.0 to 9.0
- *Hardness as CaCo3*: 50 to 500ppm
- *Alkalinity as CaCo3*: 500ppm max.
- *Total dissolved solids*: 1 000ppm max.
- *Chlorides*: 125pm max.
- *Sulphates*: 125ppm max.

Fog harvesting yields fresh water for isolated communities

UNISA's School of Agriculture and Environmental Sciences has been installing fog harvesting projects around the country to help provide clean, potable water for isolated rural communities.

This remarkable technology has been designed to be as cost effective as possible, using readily available materials and with no need for electricity.

The fog collection system consists of three six-metre-high wooden poles, mounted nine metres apart. Steel cables stretch horizontally between the poles and anchor the structure. A double layer of 30 percent shade cloth is then draped over the cables and fixed to the poles on each side. This forms a fog collection screen of about 70 square metres, with a gutter attached to its lower end.

The technology behind fog collection is extremely simple. During foggy conditions, the tiny fog particles are blown against the screen and deposited on it. As the drops become larger, they trickle downwards and drop into the gutter. From there, the water is channeled through a filter to a pipe that leads to a water collection tank.

On sunny days, nothing is collected, but on wet and foggy days, yields of 3 800 litres have been recorded.

View on a fog collection system.

The system works best when the wind is blowing and is only viable where fog occurs frequently, preferably for at least 40 days a year, and persists for a few hours at a time.. This includes the West Coast and the mountainous areas, stretching from the Soutpansberg in the north, along the Drakensberg in the east to the Cape Mountains in the south.

The first fog-collection system was erected at Tshanowa junior primary school in Venda, where the school and adjacent community now have enough water to drink, wash, clean, cook and even grow vegetables. The systems have since also been erected at a number of schools in the Lusikisiki area of the Eastern Cape. These systems are the only source of water for the schools and surrounding villages.

With South Africa already classified as a water-stressed country, many more water-thirsty communities in South Africa could benefit from similar systems.

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

This is the first in a series of short articles presenting an overview of the characteristics, performance and use of galvanized steel reinforcement in reinforced concrete construction. The information presented is extracted from Galvanized Steel Reinforcement in Concrete edited by Prof. Stephen Yeomans and published by Elsevier in December 2004, reference to which is recommended where further information is required. We have called the feature Stephen's Corner and sub-titled it "It only works when you don't need it", coined by a Cape Town Coastal and Harbour Engineer, Keith Mackie.

In this first article, topics covered include the durability of concrete, the galvanizing of steel as a corrosion protection system, and the processing, fabrication and field handling of galvanized reinforcement. Further articles will explore the behaviour of zinc in concrete, the extent of the corrosion protection afforded, design and structural considerations for galvanized reinforcement, and a portfolio of world-wide applications.

Some issues with reinforced concrete

When steel is placed in concrete it is protected from corrosion due to the formation of a protective, so-called passive, film on the surface of the metal in the highly alkaline environment of hydrated cement (>pH 12.5). For long-term corrosion protection, the concrete cover must limit the transport of aggressive species such as chloride and other ions, oxygen, carbon dioxide and other gases through to the depth of the reinforcement. The effect of these is that they change the protective nature of the concrete and/or disrupt the passive film on the surface of the steel leading to the onset of corrosion. This situation in reinforced concrete construction is broadly identified as a lack of durability.

Once corrosion of the reinforcement commences, physical deterioration of the concrete mass soon follows (*figure* 1). The reasons for this are that the various iron corrosion products formed are expansive (by a factor of 2-10x compared to iron) and their presence at the surface of the steel causes a swelling pressure sufficient to crack the concrete in tension. Once the cracks reach the external surface, a more direct entry path for the aggressive species is created and the corrosion process gathers momentum. At this stage, rust staining of the surface is usually evident and, as more corrosion products are formed, pieces of concrete may spall from the surface. In this condition, issues of public safety become a concern – the problem of falling concrete – and eventually the structural integrity of the element may be impaired.

The prevention of reinforcement corrosion

Without question, the most cost effective way to minimise the risk of corrosion in reinforced concrete is to ensure that the concrete is of appropriate quality for the intended application and that the depth of cover to the reinforcement is adequate. These are matters primarily related to the design and

continued on page 24...

Zinc in Animal Feeds Reviewed

The European Union's Scientific Committee on Animal Nutrition (SCAN) recently published a review of zinc in feeding stuffs. The Committee concludes that zinc is an essential trace element necessary for all animals which has to be provided in feed to ensure that animals cover their requirements. Currently, zinc is authorized in the EU for all species including fish at a level of 250mg/kg (Directive 70/524/EEC) and the Committee recognizes that this level exceeds the requirement of farmed livestock, fish, dogs and cats. The Committee also says that no particular risk for the environment has been identified as a result of the use of zinc in animal diets at the currently allowed levels.

The Committee recommends that current allowable zinc levels should be reviewed to better reflect animal requirements, to take into account the natural level of zinc present in feeding stuffs and to allow a safety margin – the Committee suggests that a total zinc level of 150mg/kg of complete feed would appear to be an appropriate maximum for all animals. Nevertheless, the Committee recommends maintaining comparably high levels of zinc and iron so long as copper levels are kept at 175mg/kg.

The Committee also recommends a separate review of zinc use in feeds for farmed fish, taking into account the different production systems used in Europe; and possible further consideration of zinc levels in the light of 'the possible evolution of the authorized load of zinc on soil'.

Source: Opinion of the Scientific Committee on Animal Nutrition on the use of zinc in feeding stuffs. Adopted 14 March 2003. European Commission, Health and Consumer Protection Directorate-General. (Copy available from IZA headquarters).

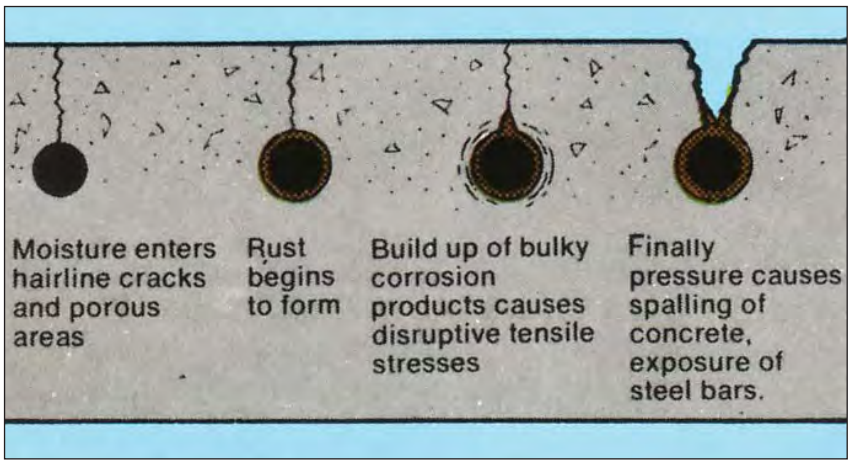

Figure 1. The progress of corrosion-induced damage in concrete.

manufacture of the concrete itself and its placement on site including positioning of the reinforcement followed by proper compaction and curing of the fresh concrete. Though this is all well understood and, if followed, a long and trouble-free life of reinforced concrete construction can be achieved, it is unfortunate that the deterioration of concrete due to corrosion of embedded steel in the form of reinforcement, bolts, fittings, anchorages etc, is not uncommon.

What then can be done to minimise the risk of corrosion in the event that the concrete mass is not of sufficient durability? A number of options are available including the use of membranes on the surface of concrete, corrosion resisting reinforcement such as stainless steels, cathodic protection of the reinforcement, or coating of the reinforcement itself. The choice of any of these supplementary protective measures is based on both economic and technical considerations. Clearly issues such as availability of the product or system, initial and long-term costs, need for repair and maintenance, and its overall suitability for the intended application are all important.

As far as coatings are concerned, galvanizing is by far the most common. Its first regular use was in the 1930s in the USA. Since this time, and especially the last 25-30 years, its use in a wide variety of types of concrete construction and exposure conditions in many countries has been widely documented. There is also a published record of both laboratory-based research and field studies of the characteristics and performance of zinc-coated steel products in concrete construction. Acceptance of the use of galvanized reinforcement is also reflected in the significant number of national and international standards for the use of zinc coated (i.e. galvanized) reinforcement published in recent years, as well as technical publications, codes of practice and specifications relating to galvanized reinforcement.

Galvanizing of reinforcing steel

Zinc can be applied to the surface of steel in a variety of ways but for structural steelwork (generally >5mm thick) hot dipping is the preferred and most widely used method. This involves immersing cleaned steel in a bath of molten zinc at about 450°C during which a metallurgical reaction occurs between the steel and the zinc. The layout of a typical hot dip galvanizing facility is shown in *figure* 2.

Detailed information on the galvanizing process and the metallurgical and corrosion characteristics of the coating layer can be obtained from the South African Hot Dip Galvanizers Association.

The key feature of a galvanized coating is that the coating is metallurgically bonded to the steel and is in effect an integral part of the

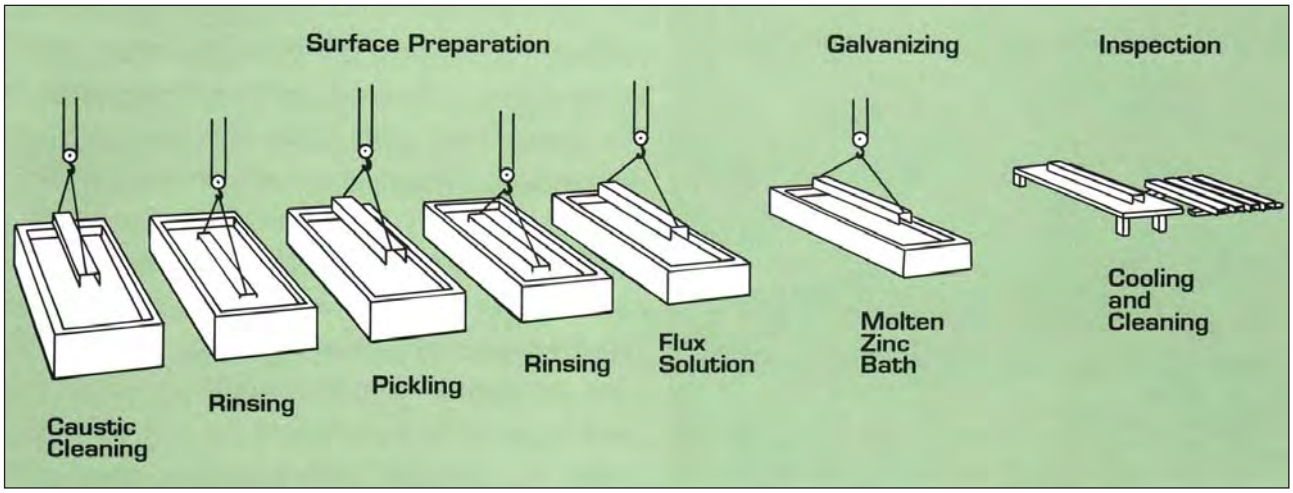

Figure 2: Schematic of hot-dip galvanizing process.

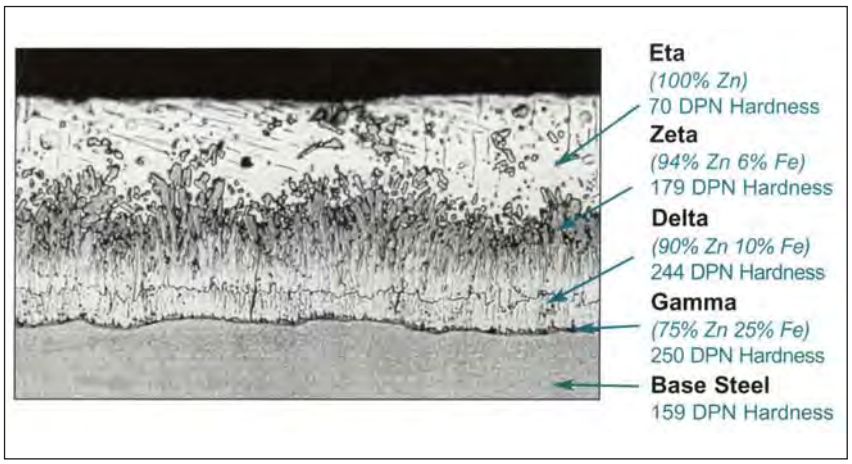

Figure 3. Photomicrograph of hot dip galvanized coating showing detail of the alloy layers and their hardness.

steel. A typical (so called bright) galvanized coating structure is shown in *figure* 3. In this the alloy layers are harder than the base steel resulting in a coating that is not only firmly adhered to the steel but is tough and hard and can resist abrasion and fairly heavy handling. It also allows the galvanized article to be handled, transported and fabricated in much the same way as ordinary steel.

Fabrication of reinforcing steels

Ideally, the fabrication of such items should be done prior to galvanizing as this sequence provides coating protection to all edges and joints and takes full advantage of the corrosion protection afforded by the zinc coating. This approach is particularly useful when complex built-up reinforcement cages such as spiral column reinforcement and precasting elements are to be coated.

When processing traditional reinforcing bar it is generally most convenient and economical to galvanize straight lengths of bar with all fabrication being done after galvanizing. During fabrication in this case the tendency for cracking and flaking of the galvanized coating in the area of the bend increases with bar diameter and both the severity and rate of bend. Although the bendability of most galvanized bar is only marginally altered from that of uncoated bar, to minimise cracking of

continued on page 26...

the galvanized coating the following minimum bend diameters (for 90° bends) are generally recommended:

- up to 16mm bar diameter – 5d bend; and
- greater than 16mm bar diameter – 8d bend.

Damage to the coating should it occur can be minimised by using large bend diameters and appropriately sized mandrels and formers. Should damage to the coating occur this can be repaired by applying zinc-rich paints, zinc solders or zinc-filled epoxy type products.

	Designation	Title
General Galvanizing Standards		
South Africa	SANS 121 (ISO 1461)	Hot dip galvanized coatings on fabricated iron and steel articles
International Standards		
Organization	ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles
Reinforcing Steel Standard		
International Standards		
Organization	ISO 14657	Zinc-coated steel for the reinforcement of concrete

Table 1. Standards for hot dip galvanizing of reinforcing bar.

Operation	Recommendation
Material receipt and inspection	• visually inspect for damage, and • check for secure tie-downs on transport.
Unloading and job site handling	• no special handling or care necessary, • lift bundles at multiple pick-up points, or • use a spreader bar with additional nylon straps to prevent sag and bar-to-bar abrasion in longer bundles.
Storage	• block material and store on a slant to allow for water drainage and air flow.
Placement	• no special care necessary.
Bar supports and tie wire	• bar supports, spacers and reinforcement supports should all be hot-dip galvanized, • 16.5 gauge or heavier galvanized tie wire should be used, or • other acceptable materials for these parts are plastic or non-conductive coated steel.
Splicing and coupling details	• a bar-lock coupler is recommended, either galvanized or stainless, • for welded splices all welds must be touched up as recommended, and • use appropriate protective masks and suitable ventilation when welding.
Field cutting	• field cutting should be avoided, and • repair of cut ends shall be done using touch-up procedures.
Final inspection and repair	• touch-up of cut and burned ends should be done following recommended procedures.
Concrete pour	• no special handling or care necessary.

Table 2. Guide to field handling techniques.

Examples of a variety of steel products commonly used in reinforced concrete construction are shown in *photo* 1. On the whole, the methods used for the handling, fabrication and transportation of galvanized reinforcement are similar to those used for traditional steel reinforcement and no special requirements or techniques need be considered.

Galvanized reinforcement may also be satisfactorily welded by all common welding techniques. Though welding can be accomplished by welding through the galvanized coating, the preferred method is to remove the zinc coating in the region of the weld and weld the exposed base metal. Some minor changes to the welding technique may need to be incorporated and the coating needs to be repaired. Again, advice on this issue can be obtained from your local galvanizing association.

Galvanizing standards

The regulation of the hot dip galvanizing of steel reinforcing bars is handled in different ways around the world. Some countries treat steel reinforcing bars in the same way as any another steel products and so the hot dip galvanizing of reinforcement falls under a general galvanizing standard. In others, dedicated Standards relating solely to reinforcing steel have been published. A summary is in *table* 1.

In these general galvanizing standards an average minimum thickness (or mass) of the coating is specified depending on the type and thickness of the base material. For structural sections heavier than 5-6mm thick, which would include reinforcement and most other reinforcing products, a minimum average coating thickness in the range 600-610 g/m^2 is specified, which equates

Photo 1. Galvanized steel products for use in concrete.

to a coating thickness of 85-87 µm. Similar requirements are in ISO 14657 for bar greater than 6 mm in diameter.

Field handling of galvanized reinforcement

As a general guide, galvanized reinforcement can generally be transported and handled in the same way using the same methods as are used for conventional black steel. It also does not require any special precautions to protect the coating against superficial damage during transport and field handling. In *Table* 2, a summary is given of field handling techniques that may be used with galvanized reinforcement.

While not meant to be fully inclusive, it is presented as an industry guide to best practice. Other issues in field handling may arise from time-to time and these should be assessed in light of these broad recommendations.

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

Deep tunnel sewage systems pre-cast concrete piping

Where it is considered that normal reinforced concrete will not have adequate durability, galvanized reinforcement is often used in preference to conventional steel reinforcement.

While concrete itself provides natural corrosion protection to steel this may be lost as a result of aggressive species from more severe environments through the coating cover.

Galvanized steel reinforcement was first used on marine piers in 1953 and has become widely used for increased protection in such circumstances.

The following article is an example of this use.

Hot dip galvanized coatings are usually applied to steel that is already fabricated. However, in a major project now under construction in Singapore, this convention is being reversed. For this project, steel in the form of loosely-coiled wire bar, is being galvanized then formed around large mandrels into cages that become the steel reinforcement for sections of large diameter concrete pipe.

The pipes are part of the Deep Tunnel Sewage System (DTSS) which was conceived as a long term solution to meet the needs for used water collection, treatment and disposal to serve the development of Singapore through the 21st century.

An integral part of the project is a large treatment plant at Changi from where a deep-sea outfall will discharge treated effluent into the Straits of Singapore at a distance of 5km from shore. The outfall comprises two parallel under-sea pipelines, constructed from reinforced concrete sections laid end-to-end in a trench in the sea-bed. Each concrete pipe section measures 3m in diameter and 8.0m in length

and contains 7-8mt of galvanized reinforcing bar (rebar). In all, the pipelines will require 1 300 individual pipe sections and will use a total of 10 000mt of galvanized rebar.

The project has presented many engineering and technical challenges for both contractors and suppliers. In the case of the ocean out-falls the need to ensure integrity and longevity of the pipelines under the service conditions encountered has required serious consideration and a deal of ingenuity.

The corrosivity of seawater coupled with the need to design for a service life of 100 years, dictated that the rebar should be coated to protect it against corrosion that could lead to spalling of the concrete, compromising pipeline integrity. The choice of galvanizing to coat the rebar was not made lightly as any coating had to be capable of withstanding site handling as well as being formed into the circular cage shape before placement in the moulds used to cast the concrete pipe sections. The method of forming the reinforcement cages required that the rebar was of reasonable length and so it was decided to use coils of rebar rather than straight lengths.

Considerable work by both the contractor and the galvanizer was necessary before the optimum rebar size was established. The decision to use coils as the start material required specialised handling techniques through the galvanizing process but too large a bar diameter would make the coils too "inflexible" for galvanizing. On the other hand, too small a diameter would not provide the rigidity required of the cage when the rebar was formed. Further, formability of the rebar was an issue as dimensional consistency of the finished cages was important to ensure the correct thickness of concrete cover.

Galvanizing was finally chosen over other alternative coatings because of its resistance to site handling damage and the ability to provide long sections of rebar that would minimise joints and cuts that could potentially compromise corrosion protection.

The Changi outfall contract was awarded to the Dutch dredging contractor Boskalis International bv with pipeline construction by its affiliate Archirodon Group nv.

The Association wishes to thank the Australian Galvanizers Association for this contribution.

Tailings Storage Facility uses hot dip galvanized reinforcement for sustainability!




The new concrete pipe foundations used for transporting water (from the Tailings Storage Facility, to the silt trap, and then into the return water dam) at South Deep Gold Mine, near Westonaria, were recently constructed. Rod Rankine of Rod Rankine Engineering Solutions cc was asked by Golders and Associates Africa for a recommendation on the coating of the reinforcement steel. "I recommended hot dip galvanized reinforcement for the concrete because the foundations would in future be inaccessible for any maintenance and South Deep Gold Mine wanted a 50 year design life" says Rod.

Client:	South Deep Gold Mine
Project Managers:	Golders and Associates Africa
Tailings Dam Designers:	Metago Environmental Engineers (Pty) Ltd.
Galvanizer:	Robor Galvanizers

On the Couch.....

Hennie de Clercq

By Desere Strydom

It is a great privilege and honour to have **Dr. Hennie de Clercq, President of the South African Institute of Steel Construction** on the couch with us for this edition of Hot Dip Galvanizing Today. We caught up with Dr. de Clercq in between meetings, 'bicycling-around' and preparations for his fortieth wedding anniversary.

How did you get involved in this Industry? I studied for a PhD in Structural Engineering at the University of California in the early 1970's. Iscor paid for my studies under the proviso that I return and work for them for a period of five years. When I returned to South Africa, Iscor gave me the job of running the South African Institute of Steel Construction, which was a fledgling organisation at that stage, where I worked for five years. I went into consulting engineering for twenty years and returned to my 'old job' five years ago.

Do you see a synergy between our industry and yours? I would deem steel as the most important material for civilisation. There is a saying that if it's not made of steel, it is made using steel. But it has one disadvantage – rust. Hot dip galvanizing is a proven method of corrosion protection with a proven track record of over a century.

Do you have a particular vision for the SAISC? Firstly growth into market segments in which steel construction is not strong enough yet and here I refer particularly to multi-storey buildings. Secondly, exports; the South African market is too small for our Industry to have 'all its eggs in one basket'. Our industry has proven itself to have the expertise and capacity to meet world class standards.

How do you see the hot dip galvanizing industry featuring in your vision? Particularly with exports I think hot dip galvanizing offers a robust corrosion protection system from a quality point of view. It is much less prone to mechanical damage than say, a paint system, particularly when transport is factored into the equation.

What is your opinion of the hot dip galvanizing industry? I think that despite all the hard work the HDGASA is doing, there is still a lot of rework being done after hot dip galvanizing. For me this goes back to steel being designed, specified and fabricated taking the hot dip galvanizing process into account and I do feel we are still lacking in this regard.

A lot of press has been given by the SAISC to light steel frame-construction? The SAISC identified this opportunity and were instrumental in putting steps in place to getting this industry on the map. To illustrate my point – it was illegal five years ago to build a light steel frame building in Gauteng. Finance and insurance were impossible to obtain, let alone finding a contractor prepared to do it. The SAISC played a leading role in changing the whole environment and is proud that this sector is showing tremendous growth despite such trying economic times.

Your opinion on the HDGASA Awards and how the programme has grown over the years? There has been tremendous progress over the past years. I would like to see more emphasis on the durability factor in the entries though. I know this is not always easy as one loses touch with project partners over the years, but I do feel that longevity is the factor that needs to be celebrated more than anything else.

You are quite involved with charitable organisations. I believe that anyone who has the privilege to enjoy the wonderful benefits South Africa has to offer is under an obligation to give something back. I was the president of the South African Alzheimer's Association as well as the treasurer of the International Alzheimer's Association. My wife and I are also quite involved in a Centre for people suffering with HIV/AIDS as well as Aids orphans.

I have it under good authority that you are a formidable cyclist. Yes I spend far too much time on the back of a bicycle (chuckles). I have recently completed the Joberg2C race, which is an off-road mountain bike race over nine days, following cattle- and footpaths over the Drakensberg Mountains and finishing in Scottbourgh. I've cycled all over the world but lately my only claim to fame in this department is that I'm usually the oldest competitor in any given race!

Tell us about Dr Hennie de Clercq. Next month I will celebrate my fortieth wedding anniversary with my wife Helena. We have a daughter who is a Psychiatrist. A passion in life is birds. My wife and I have been all over the world on birding expeditions. Naturally with this go plants, trees and other aspects of nature. I am an avid reader of non-fiction – philosophy, science, theology; a whole host of topics that make me understand how the world fits together.

For more info see: www.saisc.co.za

The Association wishes to thank Desere Strydom for this contribution.

The house in Rooi Els!

Designed on the back of a serviette over a plate of calamari in Hermanus, this vacation beach house is carefully crafted to create an extraordinary living experience! Primary design drivers revolve around minimum intrusion on the fynbos and dunes that carpet the site. By suspending the house on the dune slope allows the fynbos to be practically continuous under its footprint. Capitalising on its unique context with panoramic views from Cape Point through to Gordon's Bay, the house is conceived as a steel framed glass box with a hull shaped roof to facilitate distant elevated views to the surrounding mountains. All the external walls are sliding folding glass doors and are concealed by slatted timber shutters which open hydraulically to become a veranda. All interior walls dividing living and sleeping spaces slide away during daytime hours to create a single large space which flows out on all four edges to broad cantilevered decks. The effect created is thus an umbrella, connecting iso-tropically to the amazing environment that cradles the house.

Elphick Proome Architects Inc.

The challenge behind constructing the house that is currently under erection at the point of Rooi Els in the Western Cape was not just the barrier to entry on the environmental responsibility front. It was also a question of the barrier to the environment: *how do you adequately protect an open steel structure in such a proximity to some of the worst corrosive conditions in the Cape?*

A conceptual elevation of the house on the site.

Environmentally, Brandbild have made huge strides in protecting and rehabilitating dune vegetation outside of the site boundaries. Using non-woven fabric constructed with coconut husk, pinned to the constantly shifting sands, they have squeezed into a site literally no bigger than the footprint of the overhanging floor perimeters. In tribute fynbos grows liberally on the site establishment fences.

The location of the structure quickly focused the design team on smoothing the corrosion resistance ride for the steelwork. With a back-to-back corrosion protection guarantee for the Client in mind, a team was brought together around the design table. Terry Smith from the Hot Dip Galvanizers Association of Southern Africa, Cape Galvanising (Pty) Ltd, PPG Coatings Europe (Sigma Coatings) and fabricator Apocalypse have presented a 15 year guarantee for the duplex system as installed.

This has undoubtedly created a continued awareness for the quality issues surrounding the preparation and implementation of the system at every stage, without the traditional concerns at the interface between one trade and the next. The unusual guarantee satisfied a somewhat perturbed NHBRC, who referenced that 316 stainless steel was perhaps the only metal suitable for the site.

With the corrosion protection system defined and the team on board, attention was diverted to devising a suitable family of joints, splices and connections within the frame. The

Photo 1.

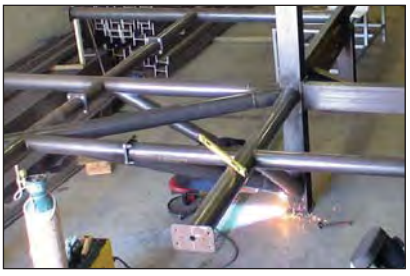

Photo 2.

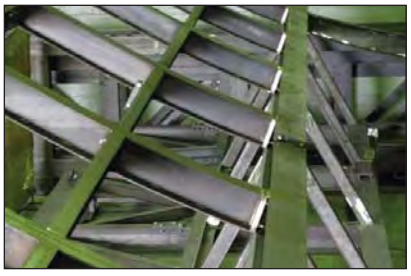

Photo 3.

Photo 4.

Photo 5.

Photo 6.

Architectural aesthetic for the steel skeleton is 'seamless', so maximising the shop fabricated 'chunks' of frame was paramount to minimise site bolting and welding. This was limited to the size of the galvanizing baths at Cape Galvanising, and transport facilities to the point of Rooi Els.

The structural design was challenging in the large clear span leaps and cantilevered overhangs demanded by the Architecture. Careful attention was paid to the deflection criteria over and around glazed sliding-folding perimeter walls, under particularly onerous wind loading conditions. A full analysis model was initiated by Linda Ness Associates, using OASYS, both for design, design interface, and towards a full understanding of the behaviour of the steelwork structure.

The structural detailing was taken to a stage just short of intricate completion by PSN using 3D environment modelling, Xsteel, in close deliberation with LNA. After collaboration with the fabricator, structural details were refined in design, revised on the 3D model and bled into a visual approval process by Elphick Proome Architects who were aware of the structural development at all stages, so to retain the original philosophies of the design. Finally the basic fabrication shop details were issued to the fabrication factory.

The balance of the intricate detailing was carried out by Apocalypse fabricators who infused the

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Photo 7.

Photo 8.

Photo 9.

Photo 10.

Photo 11.

Photo 12.

Photo 13.

inevitable complexity of minimalist architecture, open honest steel structure, and all the services in-between. In this way the initial shop details were taken to completion in the factory (*see photos* 1 - 3) Not least of these complexities was the development of a unique mechanical shutter system (*see photo* 7) that necessitates a series of complex fabrications to accommodate the moving parts. As an unusual measure: pre-drilled holes for attachment of other features on the structure such as the roof, blinds, glass, and other attachments have generated just over 1 600kg of swarf!

The Apocalypse factory floor, an area smaller than the footprint of the final skeleton, in Gordon's Bay, became a full scale prefabrication facility. Sequential lengths of the structure, both floor perimeter and roof, were fabricated and preassembled in the factory before being carved off into the carefully preplanned 'chunks' to be masked, hot dip galvanized, primed and coated at the premises of Cape Galvanising (*see photos* 4 - 6). Steel was bulk delivered onto the site for erection in two separate phases: floor perimeter and roof (*see photos* 8 - 17). All site welding is carried out on section ends that were masked prior to hot dip galvanizing and zinc metal sprayed on site prior to a final brush on paint coating system application.

The floor structure is a composite of a reinforced concrete flat slab, framed by a steel channel, and supported on a regular grillage of steel columns bolted to reinforced stub columns using isolated 316 stainless steel HD bolts (the only stainless steel utilised on the primary structures). The perimeter channel emits a regular skirt

sequence of propped and cantilevered tubular fames that support the perimeter timber slatted verandah. Tubes were used specifically in the outdoor environment to minimise the corners and heels associated with accelerated corrosion of angular hot rolled sections. And also to maximise natural wash-down during rains.

The steel columns extend uninterrupted up to the ceiling plane where they are framed by a 'toblerone' vierendeel truss that rings the house and ultimately forms a glazed clerestory. Off this truss ring, springs another series of cantilevered frames which emulate the verandah below and form a framework for the

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COATING SYSTEM		Data Sheet		Film Thickness (microns)		Minimum interval between coats at 20°C
No of Coats	Coating			Wet Film	Dry Film	
1	Sigmacover 280	7417		175	100	8 hours
1	Sigmacover 435	7465		160	100	8 hours
1	Sigmafast 210	7541		180	100	8 hours
3	**TOTAL DRY FILM THICKNESS**				**300µm**	

Table 1.

COATING SYSTEM		Data Sheet		Film Thickness (microns)		Minimum interval between coats at 20°C
No of Coats	Coating			Wet Film	Dry Film	
1	Sigmafast 210	7541		70	40	8 hours
3	**TOTAL DRY FILM THICKNESS**				**300µm**	

Table 2.

mechanical shutters, and a narrow skirt of cladded roof in which all of the services are hidden. The fabricated curved rafters and cold rolled lipped channel purlins form the ribs and grillage for a slim-line biscuit of smooth timber roof cladding, and timber ceiling.

While the project has still to be completed, it is an easy statement that no one aspect of such a project overshadows any other, and that all the designers and builders demanded full attention of the others. Corrosion protection of the primary structural mediums of reinforced concrete and steelwork were considered right from inception.

At the time of writing, 95% of the steelwork is erected, no fabrication adjustments have been required to the factory pre-fit and only two dozen or so holes drilled on site, which is testament to the attention. This in turn means the conservation of the protection system remains optimal, ahead of final wash down and the application of the site coat.

Steelwork corrosion protection system

As the atmospheric conditions are fully marine (typically C5), we believed that a comprehensive coating system was necessary in order to achieve a high degree of corrosion control and ultimately satisfied customers. The coating system comprised the following:

- All structural steelwork other than the tubing was abrasively blasted prior to hot dip galvanizing. The reason for this was although abrasive blasting is not necessary prior to hot dip galvanizing, we felt that there are occasions when the fillets of structural I-beams and channels show an unsatisfactory roughness, which if not removed often result in a rough hot dip galvanized coating along this area. The roughness would be more than amplified when hot dip galvanized and over coated with paint.
- Hot dip galvanize to SANS 121 (ISO 1461).
- The hot dip galvanized coating was then mechanically cleaned to remove obvious surface roughness, bumps and lumps to an acceptable degree of "smoothness" (This is relative when compared to the gas or air knife wiped surface of continuously hot dip galvanized sheeting). The coating was then chemically cleaned using scotch brite pads and an appropriate GIC (Galvanized Iron Cleaner).
- The cleaned hot dip galvanizing was then factory painted, as shown in *Table* 1.

Application in the factory was done by airless spray

To eliminate bolted joints (for aesthetical purposes) all the joints

Photo 14.

Photo 15.

Photo 16.

Photo 17.

were site welded to ensure a degree of structural smoothness. The applicable sections were treated using a mask, 'Galvstop' to ensure the localised exclusion of the hot dip galvanized coating. (This is essential when welding for structural purposes). The subsequent paint system was then also cut back appropriately, so that each coating, including the hot dip galvanizing could be appropriately re-instated after site welding took place.

Once all the site coating repairs have been completed, the entire structure will be painted, for uniformity by brush or roller as follows:

Surface preparation

Rinse surface with potable water to remove salts. Degreaser must be used if surface has been contaminated with mineral or vegetable oil or grease

Coating System

See *Table 2*.

continued on page 38...

Application on site must be done by brush or roller

Special requirements from the paint manufacturer

All surface preparation and application shall be in accordance with the relevant product data bulletin, this specification and the general painting specification of Sigma Coatings.

It is the responsibility of the applicator to ensure that he can achieve the required DFT of any and all the required coats in a single operation. If multi-coats are required due to method of application or other, they shall be applied per the instructions of Sigma Coatings and all additional labour shall be for the sole account of the applicator.

If the surface becomes contaminated between the coats, the surface shall be washed thoroughly to remove all contamination prior to application of further coats.

The applicator is responsible to have an operational and auditable Quality Control and Assurance program in place.

The applicator shall have full time and identifiable supervision on site at all times.

Total overall coating thickness including the hot dip galvanizing once finished will be about 450µm.

A COMPREHENSIVE COATING SYSTEM!

Acknowledgements

Architect: *Elphick Proome Architects Inc.*

Engineers: *Linda Ness Associates cc*

Specialist Consultant: *Terry Smith*/HDGASA

Contractor: *Brandbild Pty (Ltd)*

Fabricator: *Apocalypse cc*

Galvanizers: *Cape Galvanising (Pty)Ltd*

Paint: *Sigma Coatings*

Applicator: *Cape Galvanising (Pty)Ltd*

NOW WITH CPD POINTS

Galvanizers Inspectors Course

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

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

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

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

COURSE CONTENT

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

COURSE DURATION

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

DATE AND TIME

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

Johannesburg:
February 16 - 17; March 17 - 18; April 20 - 21; May 18 - 19; June 22 - 23; August 17 - 18; October 5 - 6 and November 23 - 24.

Cape Town:
May 11 - 12; September 7 - 8.

COURSE COST AND PAYMENT TERMS

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

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

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

Corrosion Risk Management Courses

Two-day, CPD accredited courses (2 CPD points) on corrosion risk management are being offered at various times during the year by Ithuta JV at their training centre in North Riding, Johannesburg. The course can also be provided in-house at clients' premises. Ithuta JV is an engineering training company established by Len Pretorius and Bob Andrew, both ex Anglo Platinum.

The main focus of the risk management course is the use of a systems, or holistic, approach to corrosion and corrosion protection. Corrosion and corrosion protection are complex interdependent systems with diverse relationships to operational and business goals and objectives. A systems based methodology provides an excellent basis for postulating how complex corrosion mechanisms can arise, how corrosion risks impact on profitability and how corrosion risks should be optimally evaluated and managed.

In all industries and businesses, the competency to identify and control risks is a major component of successful management. Corrosion is a significant threat to many industries and the ability to systematically identify and evaluate corrosion risks is a essential aspect of good business and safety management.

Further information on these courses, and the dates on which they are being provided, as well as information on other CPD courses can be obtained from the IthutaJV website (www.IthutaJV.com) or by contacting Lisa Mncube at lisa@astidian.com .

CPUT Architectural students tour

A group of final year CPUT Architectural students (below) enjoy some technical tips from two of our Cape Town galvanizing members. The combined groups subsequently listened to a two hour presentation on hot dip galvanizing and duplex coating systems.

A Cape Town Consulting Engineer and staff tour a hot dip galvanizing facility (below).

The logic of collaborative partnerships

Two powerful influences in business are globalisation and new technology, often described as 'racing toward the world' and 'racing toward the future', respectively.

For South Africa, these driving forces hold great significance since they have come at a stage when we are grappling with our external 'coming out' from self-inflicted isolation. There is little doubt that the changes and problems facing us since the elections in 1994 are being compounded by the challenges of globalisation and technology. We have to find ways for dealing with internal political and social transformation in conjunction with these externally focused forces. We have to tackle them together. When complex forces interact, the only way of dealing with them is to find some simple unifying factors that help our understanding and empower us to seek opportunities within the complexity.

Globalisation has made new markets available and we need to reach them. We also need to plug skill gaps so that our companies can prepare and equip themselves for the international stages. Technology is driven by the constant creation of new applications and the formation of networks and coalitions, which has led to an urgency to build and develop new competencies. How can these seemingly disparate factors be unified?

The answer surely lies in commonality and synergy. Reaching new markets creates new opportunities. Plugging skill gaps involves building new competencies. Networking and coalitions help companies to become international players. It is thus clear that globalisation and technology are not separate issues but are closely interrelated. To exploit opportunities we need to exploit new technology, and vice versa.

Linking globalisation and technology helps to clarify the situation, but are there any other unifying factors? The answer to this question seems to lie in partnerships.

Partnerships have three important benefits for globalisation challenges and technology. Collaboration brings about competitive strength; specialised, costly and scarce resources can be shared and competence can be gained by co-operative learning.

Partnerships can be the catalyst for effective and durable transformation in our country by facilitating the sharing of resources, skills and knowledge between the various social and organisational groupings. Having evolved from a divided nation, we now have an opportunity to avail ourselves of a new spirit of co-operation between all groups.

Partnerships do not come easily; they require an understanding of, and a willingness to practice

fundamental human values like co-operation and trust, and care. They also need a respect for diversity and an appreciation of the importance of innovation-the cornerstone of any effective partnership. Our great diversity is a valuable resource, which many countries do not have. We must protect and promote it by emphasising the strength in differences and the weakness in conformity. Harmony never produces creativity.

There are several key issues that have to be addressed before partnerships can be used to exploit opportunities and help in the transformation of our country.

A vitally important key issue is a greater spirit of collaboration. Companies need to be continually seeking partners with whom they can collaborate for mutual benefit. Mergers and acquisitions are generally not partnerships if they promote conformity and not diversity: diversity is essential for the innovation that drives partnerships.

Collaboration can also be practised within companies by greater emphasis being placed on co-operative experiential learning among employees at all levels and across functional and departmental boundaries. Collaboration can add to bottom line profits and be the catalyst for human potential development. Collaboration that produces innovation produces new opportunities and new competencies, all of which promote job creation. Information and knowledge management are also important. While there is generally no shortage of information, the effective interpretation and application of such information to produce usable knowledge is often not as prominent. It is not only the availability of suitable information technology, to transfer and manipulate the information, that is important, it is also the environment that encourages people to share their knowledge with each other that often dictates how well new knowledge is produced. The culture of sharing that arises in effective partnerships encourages the sharing and transfer of knowledge.

Probably the greatest challenge of all is for companies to have a strategy in place that has clearly identified those areas where collaboration will be beneficial, what resources and skills can be shared, how they can be shared and what the objectives are for such sharing. Without a strategy, it will be extremely difficult, if not impossible, to develop a shared vision with a potential partner.

A shared vision is a dream that we all have. A dream in which our country is participating in the race toward the world and toward the future. Partnerships can help all of be participants in this race.

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.

The real protection is hidden!

While hot dip galvanizing is frequently used for protection of steelwork on its own and is easily seen to be doing this, there are many instances where the coating is hidden and performs the essential back-up of corrosion control to various forms of over coatings and covers.

An example of this is when duplex coating systems are applied and while the performance of the two systems is working synergistically to provide the corrosion control solution, the hot dip galvanizing is out of sight.

Similarly, when reinforcement for concrete is hot dip galvanized it too is providing the essential back up but hidden!

The petrol service station steelwork is also an example of this, that when cladded in corporate colours, we know that hot dip galvanizing will provide the back up required for sustainability!"

Galvaspin introduces a zinc thermal spraying facility at their works in Port Elizabeth

As an extension to the services of hot dip galvanizing, Galvaspin in Port Elizabeth has recently introduced a thermal spraying service to compliment corrosion protection by hot dip galvanizing.

Briefly, thermal spraying by zinc provides the following benefits:

- Superior method of repairing hot dip galvanizing.
- Relatively low heat transfer from the sprayed particles to the substrate causes no deformation.
- Almost no limitation on the size of component or structure which can be treated.
- Thermal spraying may be handled immediately after treatment. There are no protracted drying times.
- Thermal sprayed metal coatings are more robust than paint systems and are consequently able to withstand rougher usage.
- There is no distinct limit to the thickness of sprayed coatings. Zinc may be sprayed to over 3mm and unlike hot dip galvanizing, thickness may be varied from place to place to provide greater protection in critical areas.
- Even if a sprayed deposit is locally damaged, the sacrificial action particularly of zinc prevents corrosion from edges and discontinuities. It may also delay the onset of rusting of structures which have been neglected.
- Thermally sprayed coatings can be painted for enhanced corrosion protection or colour.

Robor achieves 1 000 000 man hours free of disabling injuries!

Over the past few years, Robor Galvanizers have been working hard on a number of initiatives outside of the day to day technical galvanizing issues.

Robor (Pty)Ltd, Robor Galvanizers parent company, are totally committed to all aspects of providing a clean and safe working environment, being environmentally compliant, and providing products and workmanship of a high quality standard.

In line with this, Robor Galvanizers have been accredited with ISO 14001, ensuring that the entire operation in Germiston is environmentally friendly and legally compliant. This initiative includes the installation and commissioning of a Water Treatment plant. This is besides the ISO 9001 accreditation which has been in place for some time.

With regard to safety, in January this year, Robor Galvanizers achieved 1 million working hours being free of any disabling injuries. Continual heavy focus is placed on safety in the workplace, especially as we are constantly handling thousands of irregular shaped steel pieces every single day!

In January 2009, Robor Galvanizers was officially audited by NERA in regard to their BBBEE status, achieving a Level 4 status. Earlier this year, the renewal audit was undertaken, with a revised rating of Level 3 being achieved. This enables customers to claim 110% of their spend with Robor Galvanizers under the Preferential Procurement category of the BEE compliance.

The management at Robor Galvanizers are committed to a course of continuous improvement closely aligned to the needs of their broad customer base!!

[Your galvanizer of choice]

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

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

Newly upgraded!

- 5 000m² ~~4 000m²~~ concreted lay down area added to enhance our offering
- Line 2 kettle with a totally matched processing facility
- 4m deep • 2m wide • 10m long

Benefits to you:

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

Logistics capabilities include:

- Lay down areas
- Crane capacity
- Transport fleet

robor

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Hot Dip Galvanizers Association Southern Africa

The Hot Dip Galvanizers Association of Southern Africa was founded in 1965 and it's membership represents some 90%, by value, of the general hot dip galvanizers operating in South Africa. The Association also represents both continuous sheet and wire galvanizing members.

The Association's primary mission is to develop and expand the demand for hot dip galvanizing and duplex systems (hot dip galvanizing plus paint) as viable and economical corrosion protection systems. We endeavour to identify new market opportunities that benefit members, end-users and all other stakeholders.

The Association is well positioned to increase awareness among, end users, engineers, consultants, contractors, specifiers, designers and architects by way of presentations and plant tours and by getting involved at the design stages of major developments.

We provide free technical advice to members concerning galvanizing plant and equipment, process controls, the control of environmental pollution and waste minimisation. Training courses in this regard are also available.

We cover the full range of hot dip galvanizing including continuous galvanized sheeting, wire, tube, centrifuge and general hot dip galvanizing of heavy fabricated structural steel components.

All members of the Association undertake to provide customers with a committed, reliable and professional encounter and subscribe to the Code of Ethics of the Association. The Code of Ethics Statement encompasses good business practice among members and their customers.

The Association publishes promotional literature such as the Steel Protection Guide, Practical Guidelines for the Inspection and Repair of Hot Dip Galvanized Coatings, Design Wall Chart and the quarterly "Hot Dip Galvanizing Today" magazine which has been extremely well received in the market. Much of this information is contained on our web site www.hdgasa.org.za.

We at the Hot Dip Galvanizers Association of Southern Africa are passionate in our belief of Hot Dip Galvanized and Duplex Systems as a reliable, viable and cost effective method of protecting steel from corrosion and to this end invite you to contact us for further discussion.

Zinc May Improve Effectiveness of HIV Drugs

Drugs based on cyclam, a simple cyclic molecule, show promise in the war against HIV by blocking the path of the virus into cells. Researchers at the University of Edinburgh in Scotland have shown, using spectroscopic techniques, that zinc binds rapidly to cyclam at conditions close to those found in blood. Following reports that zinc increased the efficacy of a cyclam-based drug, Peter Sadler and colleagues believe that zinc is likely to prove crucial in understanding how cyclam-based drugs are recognized by the cell. The team was surprised to find that zinc bound more rapidly than copper under similar conditions.

Source: Chemistry World/Feb 2004
*http://www.rsc.org/is/journals/current/chemscience/ch*00402N016c.htm

It should have been hot dip galvanized

While we realise that many proprietary components are inadequately protected from the onslaught of corrosion in aggressive marine and industrial atmospheres, it would be nice if a range of door latches such as the one shown was available in hot dip galvanized form!

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.*

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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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