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AWARD WINNING GALVANIZING DELIVERS VERSATILITY, DURABILITY AND COST-EFFECTIVENESS

In this issue

Melbourne University Arts West Redevelopment

Welcome to the latest edition of Galvanize! This edition profiles the latest Sorel Award winners, with detailed case studies illustrating the skill and expertise clearly present in each of the award-winning projects.

The $66 million **Arts West Redevelopment** at the University of Melbourne won the 2017 Sorel Award. This project features one of the most stunning and distinctive louvered façades in Australia, all manufactured from hot dip galvanized steel.

The judges for the 2017 awards, **Arun Syam (Liberty OneSteel)** and **Peter Dove (GHD)**, commented that the immediate visual impact of the galvanized façade, complete with abstract embossed images from the University's Cultural Collections, illustrated a high degree of versatility in the use of galvanizing. The project clearly demonstrated the potential of durable, non-flammable galvanized façades, as well as the technical and engineering challenges that must be met to provide the best possible economic, environmental and social outcomes for the asset owner.

Receiving a commendation from the judges, the **Mars Stadium** redevelopment in Ballarat was jointly funded by the City of Ballarat and the Victorian State Government. The project delivered a world class stadium and brought AFL to Ballarat. This brilliant new precinct will boost jobs, attract visitors and give locals a chance to see their sporting heroes in action. Importantly, Mars Stadium showcases the use of hot dip galvanized coatings for stadia structures, rather than the typical architect-preferred white paint coatings.

The final article in this issue of Galvanize! describes the cost and durability benefits of using hot dip galvanizing as compared to other coatings. We feature several recently completed projects among the many thousands of galvanized steel buildings in Australia and introduce the concept of life cycle costing of coatings using independently developed methods.

We hope you enjoy this issue and welcome feedback from readers. If you require further information about any of the stories in this edition, please feel free to contact the GAA.

Peter Golding
Chief Executive Officer

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Editorial
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Sally Wood (wordly.com.au)

Prepared by
Galvanizers Association of Australia

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MELBOURNE UNIVERSITY ARTS WEST CASE STUDY

SOREL AWARD
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University of Melbourne Galvanized to Face the Future

The $66 million Arts West Redevelopment Project was one of the University of Melbourne's most significant infrastructure projects in recent years. The project enabled the creation of dynamic new teaching and learning spaces for staff and students alike at the university's Parkville campus.

A major component of the Arts West Redevelopment Project was the renovation of the university's Faculty of Arts building on Macleod Road. The new building, built over seven levels on Professors Walk opposite the heritage Old Arts Faculty Building, provides the University's Arts Precinct with a dedicated, high-quality teaching and learning environment.

The new building reflects the latest pedagogical thinking as applied in the Faculty of Arts curricula. In an era when campuses must offer something beyond online study, Arts West's spaces are tailored to project-based collaborative, interactive, seminar, discursive and didactic modes of teaching and learning.

One of the most stunning and distinctive visual features of the new Faculty of Arts building is its louvered façade, which involved ground-breaking use of steel. The building effectively has two skins: a glass wall and a structure of parallel horizontal steel fins or louvres – resembling deep exterior Venetian blinds. The steel sections of each louvre have been shaped so that they form part of a series of 3D images. The images are 'pressed' into the façade and reveal themselves to viewers at different times of the day and from different viewpoints.

The series of images 'pressed' into the façade feature selected objects from the University of Melbourne's 23 Cultural Collections and represent the concept of object-based learning – the philosophy for which the building was custom designed. The façade is both a passive solar-control element and an architectural manifestation of the Faculty of Arts.

Galvanizing the Steel Louvres

To protect the steel from corrosion and add visual appeal, the project team opted to galvanize the louvres. Industrial Galvanizers – a member of the Galvanizers Association of Australia (GAA) – was engaged to coat the 480 individual steel sections in zinc prior to their delivery to the University of Melbourne construction site.

The project team chose galvanizing due to its durable nature, commenting that the stability of the galvanized surface meant that the time between maintenance inspections is much longer than other products, thus reducing the life cycle costs of the structure.

Industrial Galvanizers' plant in suburban Campbellfield, north of the Melbourne CBD, completed each batch of the galvanized steel louvres within an average turnaround of two to three working days in the plant.

While the iconic façade on the Arts faculty building was being installed, Industrial Galvanizers had to contend with the constraints of restricted site access for the trucks delivering the oversize galvanized sections. The University of Melbourne is in a leafy area north of Melbourne's CBD, but most of the buildings are nestled close together with narrow laneways between them, making it difficult to manoeuvre large vehicles.

According to Aaron King (Managing Director, Industrial Galvanizers Australia), "All the façade sections were numbered as they had to be installed in a very precise sequence," King added. "It was a challenge to get the semi-trailers in and unload the steel because they had to be taken off in such a way that they could be lifted up the building without double handling." The panels were packed with spacers and carpet so that the coating would not be damaged as the client wanted to maintain an 'architectural' look and finish. The sequencing was a critical aspect of the project to ensure the shaped sections correctly formed the embedded image.

The durability of the galvanizing process meant stacks of panels could be stored on site with exposure to the elements and a construction environment. The coating has a unique metallurgical structure which gives outstanding resistance to mechanical damage in transport, erection and service.

Different environments are classified on a scale of C1 to C5, with C1 being a very benign location to C5 being extremely severe in terms of temperature

The Arts West facade features several of the University of Melbourne's Cultural Collections.

To protect the steel from corrosion and add visual appeal, the project team opted to galvanize the louvres.

extremes, humidity and corrosive components such as salt or chemicals. Average suburban areas – such as where the University of Melbourne is located – are mostly classified as C2.

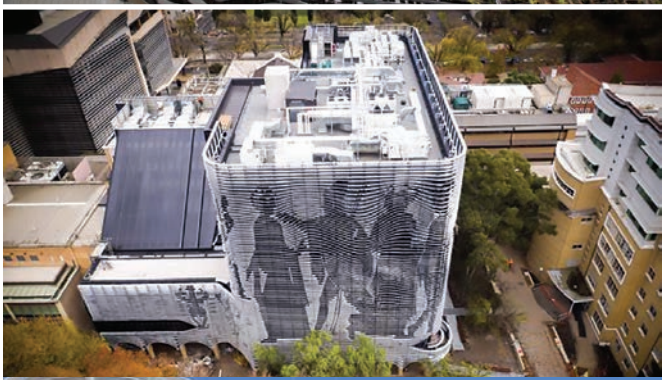
The Standard AS/NZS 4680 called for minimum average zinc coating thickness of 85 microns for the items galvanized in this project. The estimated life-span and performance of a galvanized structure is calculated using the thickness of the zinc coating and the severity of the operating environment. Combining the results – Parkville being C2 and the zinc thickness meeting the requirements of the Standard – gives the new façade an expected life-span of more than 99 years.

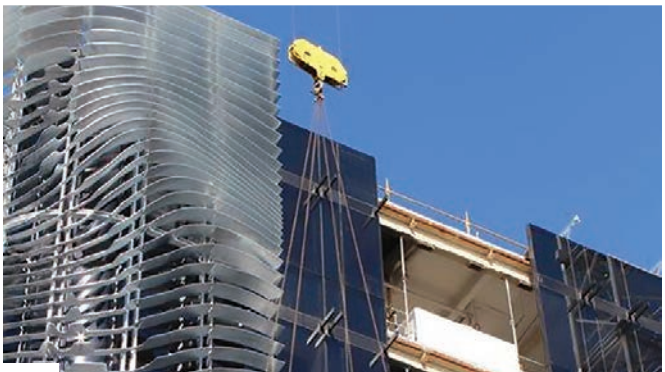
A galvanized structure lasts longer and requires less frequent inspections, so in the vast majority of cases is the cheapest process in the long term. Every part of a galvanized article is protected, even recesses, sharp corners and inaccessible areas. No coating applied to a structure or fabrication after completion can provide the same protection. Maintenance requirements add to the life-cycle costs of any facility or structure, especially when work shutdown or disruption to production is involved.

According to King, "Galvanization provides a long lasting, tough, durable coating that provides complete corrosion protection both inside and out, in addition to enhancing the appearance. However, the choice of coating ultimately depends on what the client needs, plus galvanization is not appropriate for every situation. Asset owners need to consider initial cost, lifecycle costs, aesthetics and the environment when choosing a coating system."

PROJECT TEAM

Developer and Owner: The University of Melbourne
Architect and Specifier: ARM and Architectus
Project Manager: Aurecon
Main Contractor: Kane Constructions
Structural Engineer: Irwinconsult
Steel Supplier: BlueScope
Steel Fabricator: Fab Metal Specialists
Hot Dip Galvanizer: Industrial Galvanizers





West facade features several of the University of Melbourne's Cultural Collections.

MARS STADIUM GALVANIZERS KICKING GOALS IN BALLARAT

SOREL AWARD
FINALIST 2017
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Funded by the City of Ballarat and the Victorian State Government, Ballarat's Eureka Sports Precinct is undergoing a $38.5 million redevelopment.

The redevelopment includes the recently completed $15 million upgrade of Mars Stadium, $9 million for extra courts at the Wendouree Sports and Events Centre, $5 million for the Ballarat Showgrounds, and $2.5 million for CE Brown Reserve.

Ballarat's Major Events Precinct redevelopment will be the first regional facility for sports and entertainment of its kind in the western district. The commitment by the AFL to host matches at the new Mars Stadium has been an enormous drawcard for the facility, which is expected to attract an extra 1,500 participants per year, boost visitor numbers to Ballarat by 21,000 and increase tourism spending by up to $3.6 million annually.

According to Victorian Premier Daniel Andrews, "We said we'd deliver a world class stadium and bring AFL to Ballarat – and that's what we've done. This brilliant new precinct will boost jobs, attract visitors and give locals a chance to see their sporting heroes right here in Ballarat."

The redevelopment of Mars Stadium was finalised in July 2017, just in time for the AFL's Round 22 match between the Western Bulldogs and Port Adelaide. The upgrade features a better playing surface with the same dimensions as Etihad Stadium, capacity for 11,000 spectators, 37m tall light towers and a 50m^2 video scoreboard. Plus, the Western Stand features a cantilever roof with 5,000 undercover seats.

Local Ballarat company Nicholson Construction completed the build and awarded more than 75% of sub-contracting work to locally based suppliers, creating 30 new jobs during construction. Plinius Engineering undertook the steel fabrication works and Kingfield Galvanizing delivered over 300 tonnes of hot dip galvanized steel for a project that was originally specified as a 'paint over steel' job.

Detailed Steel Work

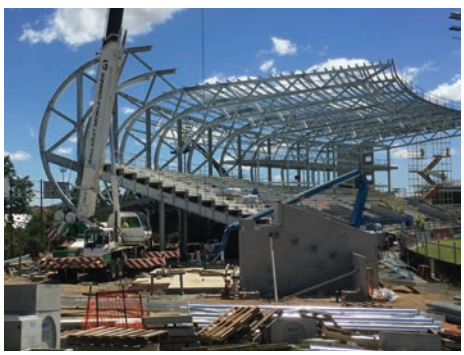
Mars Stadium features large amounts of detailed steel work. The architectural highlight of the project was the cantilever roof design for the Western Stand, which was constructed using galvanized steel in a truss design. The metal roof deck needed to be light – ensuring ease of installation – while remaining strong enough to withstand the necessary wind and earthquake loads for the Ballarat area. The curved arch form was created using infill frames, while the seating structure was designed to stabilise the roof load. The weight of the seating platforms work in conjunction with the structural steel supports to anchor the entire structure to the ground.

According to Wayne Squire (Director, Plinius Engineering), "The steel was all 350 grade. The thickness varied, depending on what the members were doing. Obviously, the Western Grandstand, which was the largest component of the stadium, also has the largest steel members. The engineers were clever, with a good use of steel. They've used a truss design, instead of just large, heavy steel beams. This adds an architectural feature to the stand, as well as producing a stronger, lighter structure."

"The machinery which we used here to process the structural steel for the stadium is state of the art. The main machine that we have is only one of five in Australia, I believe. We also have twin robots which cut and processed our steel. They cut to absolute precision, which took away a lot of the hard drilling and grinding."

"From there, we have our other flatbed cutters, which produced the componentry, the plates, the connections. These then went to the assembly area where we used our computer cut steel and put it all together into individual members. These were then sent off to be galvanized and then installed on site," said Squire.

The redevelopment of Mars Stadium was finalised in July 2017, just in time for the AFL's Round 22 match between the Western Bulldogs and Port Adelaide.



Hot Dip Galvanizing

The stadium was originally specified as a three coat 'paint over steel' structure. However, the project's protective coating was quickly altered to hot dip galvanizing for several reasons.

The fast turnaround of galvanizing was a significant reason for altering the original specification, particularly given that the lead time on delivery was half that of 'paint over steel'. The delivery date of the project had very little flexibility, with the first AFL match scheduled for 19 August 2017.

The second contributor to the selection of hot dip galvanizing was the cost. With 360 tonnes of steel to be coated, hot dip galvanizing delivered a cost saving of approximately $200,000. Overall, the Mars Stadium delivered incredible value for money, with a construction cost of $3,000 per undercover seat, compared to the industry standard of $10,000 per undercover seat in similar stadiums.

The third factor that influenced the choice of galvanizing over paint was the benefits of 'time to first maintenance'. As Mars Stadium is located in a regional centre (a C2 corrosion zone), the 'set and forget' value of galvanizing was difficult to ignore.

According to Andrew Stone (General Manager, Kingfield Galvanizing), "The main advantage of hot dip galvanizing the stadium was the durability. As opposed to paint, the lifecycle is greater in terms of years to first maintenance."

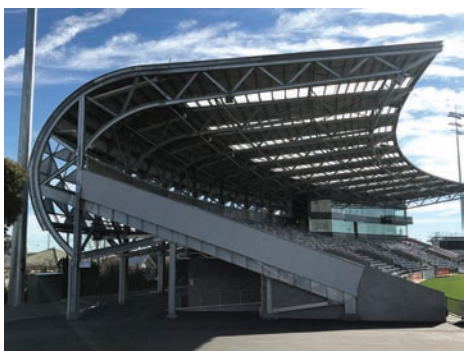
Kingfield Galvanizing worked with Plinius to hot dip galvanize the steel components for both the Northern and Western Stands. Across the stadium project, 360 tonnes of steel and 19,000 bolts where used in the construction of hot dip galvanized columns, curved rafters, handrails and cladding frames on the stadium. The stadium design also included a number of over dimensional works, including 3.5m wide frames and trusses up to 18.5m long. These frames required double dipping and specialised logistics from Plinius Engineering to Kingfield Galvanizing, before delivery directly to the Ballarat site, all within short lead times.

"Once the steel arrived at our facility, it went through a pre-treatment then through a dryer and into the molten zinc, which is basically the galvanizing process. Then it went into a water quench, so that slows the oxidization down. Then it was basically on the truck and back to Ballarat," said Stone.

The main advantage of hot dip galvanizing the stadium was the durability. As opposed to paint, the lifecycle is greater in terms of years to first maintenance.

Stadium Statistics
354 tonnes of steel
19,379 bolts
16,987 total parts

PROJECT TEAM
Developer and Owner: City of Ballarat
Architect: Peddle Thorp
Main Contractor: Nicholson Construction and Atelier Projects
Steel Supplier: Surdex and GAM
Steel Fabricator: Plinius Engineering
Hot Dip Galvanizer: Kingfield Galvanizing



GALVANIZING: COST-EFFECTIVE CORROSION PROTECTION MEASURE FOR BUILDINGS

Hot dip galvanizing protects steel from corrosion by providing a thick, tough, metallurgically bonded zinc envelope, which completely covers the steel surface and seals it from the corrosive action of its environment.

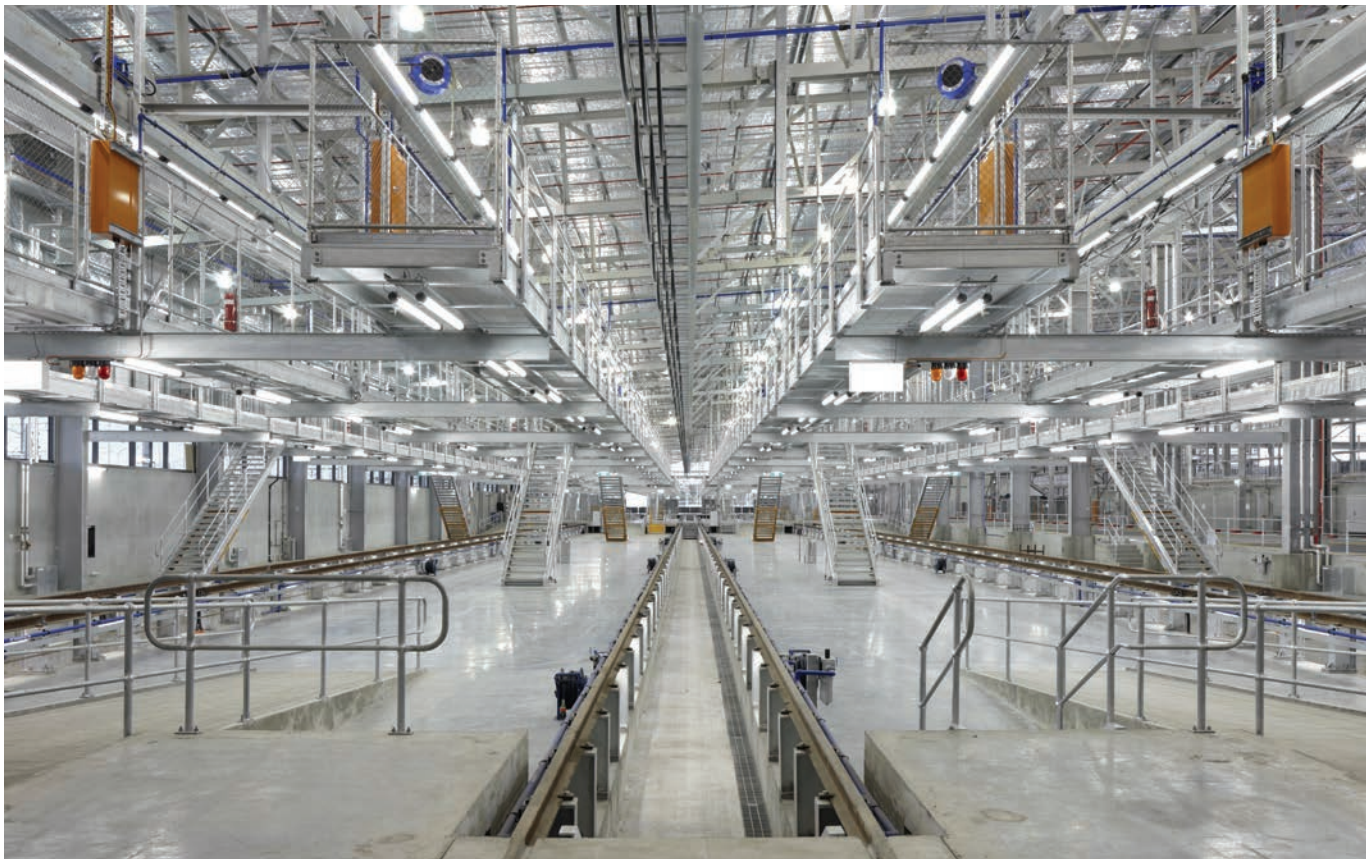
According to Peter Golding (Chief Executive Officer, Galvanizers Association of Australia), the use of galvanizing for structural steel protection provides major measurable benefits. "The galvanized coating provides outstanding abrasion resistance. Where there is damage or minor discontinuity in the sealing coat of zinc, protection of the steel is maintained by the cathodic action of the surrounding galvanized coating," said Golding.

"Metallic zinc is strongly resistant to the corrosive action of normal environments and hot dip galvanized coatings therefore provide long-term protection for steel. By contrast, most organic paint coatings used on steel need frequent renewal and when coatings are breached, corrosion begins at the exposed area of steel and spreads rapidly beneath the film," said Golding.

Craigieburn Train Maintenance Facility (photography: Dianna Snape)

Top Ten Benefits of Galvanized Steel

1. **Lowest first cost.** Galvanizing is lower in first cost than many other commonly specified protective coatings for steel. (The application cost of labour intensive coatings such as painting has risen far more than the cost of factory operations such as galvanizing.)
2. **Less maintenance and low long term cost.** Even in cases where the initial cost of galvanizing is higher than alternative coatings, galvanizing is almost invariably cheapest in the long term (because it lasts longer and requires less maintenance).
3. **Long life**. The life expectancy of galvanized coatings on typical structural members is more than 50 years in most rural environments, and over 20 to 25 years in severe urban and coastal environments.
4. **Reliability.** Galvanizing is carried out to AS/NZS 4680, with standard, minimum coating thicknesses applied. Coating life and performance are reliable and predictable.
5. **Toughest coating.** A galvanized coating has a unique metallurgical structure which gives outstanding resistance to mechanical damage in transport, erection and service.
6. **Automatic protection for damaged areas.** Galvanized coatings corrode preferentially to steel, providing cathodic or sacrificial protection to small areas of steel exposed through damage. Unlike organic coatings, small damaged areas need no touch up.
7. **Complete protection.** Every part of a galvanized article is protected, even recesses, sharp corners and inaccessible areas. No coating applied to a structure or fabrication after completion can provide the same protection.
8. **Ease of inspection.** Galvanized coatings are assessed readily by eye, and simple non-destructive thickness testing methods can be used. The galvanizing process is such that if coatings appear sound and continuous, they are sound and continuous.
9. **Faster erection time.** As galvanized steel members are received they are ready for use. No time is lost on-site in surface preparation, painting and inspection. When assembly of the structure is complete, it is immediately ready for use, or for the next construction stage.
10. **A full protective coating can be applied in minutes.** The galvanizing process is not dependent on weather conditions.



Galvanizing Versus Other Coatings

The *Durability in Buildings Handbook*[1] produced by the Australian Building Codes Board (ABCB), states that the normal design life for most buildings is 50 years. Although, this will be influenced by factors such as service conditions, material characteristics, design and detailing, workmanship and maintenance.

The normal building design life can be extended in some instances using preventative maintenance and protection measures. For instance, in most urban and rural environments in Australia, a high performance hot dip galvanized coating will protect structural steel from corrosion for more than 50 years with minimal maintenance required.

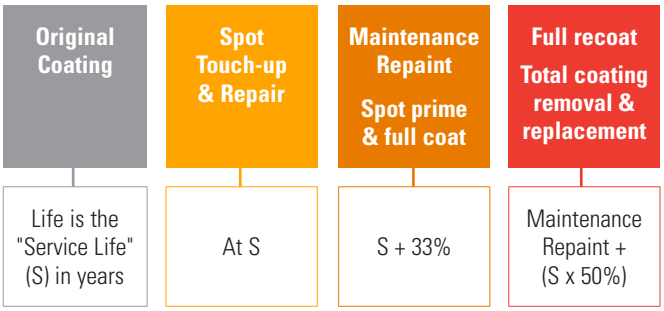
But how does a hot dip galvanized coating compare – in terms of longevity, durability and cost – to typical corrosion protection paint coatings? The Galvanizers Association of Australia (GAA) has compared the life cycle cost of a typical hot dip galvanized coating on structural steel to that of the most popular paint systems on the Australian market, with surprising results.

Coating Maintenance

All coatings need maintenance during the life cycle of a structure – some sooner than others. The service life of a coating is usually never the same as the design life of the structure. However, most coatings degrade slowly, allowing for several cycles of maintenance prior to a full recoat. As such, with suitable maintenance, coatings can be maintained to ensure the structure remains free from significant corrosion for the design life of the structure.

According to NACE International - The Worldwide Corrosion Authority, the first step in a maintenance cycle for a coating usually is a spot touch up at the end of the service life. It is at this stage that the surface typically shows approximately 5% red rust. After another period of service – typically one third of the original service life of the coating – a more complete maintenance repaint is undertaken. Finally, after another period of service – around half the original service life – a full recoat is usually required.

Figure 1: Typical coating maintenance cycle.



Modern paint coatings are available in a wide range of product types and can be applied in the factory or on-site with price points to suit most budgets. Unfortunately, many of the cheaper solutions are not effective in the corrosive environments predominant in Australia. This results in never-ending, increasing expensive maintenance costs for asset owners as their buildings age.

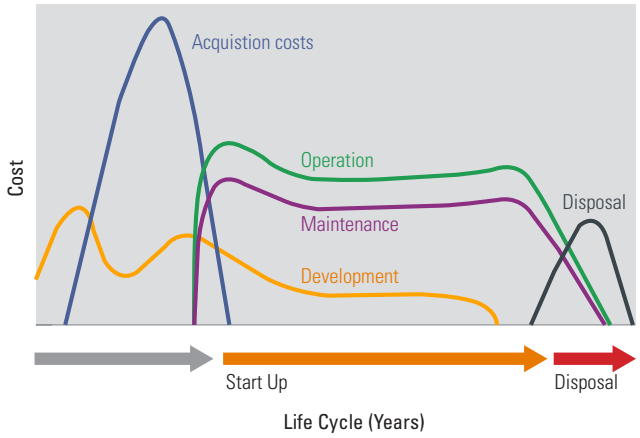
[1] Durability in Buildings Including Plumbing Installations, Australian Building Codes Board, 2015.

GALVANIZING: COST-EFFECTIVE CORROSION PROTECTION MEASURE FOR BUILDINGS *CONTINUED*

The Cost of Coatings

The true cost of a coating system needs to consider the initial cost of the coating, as well as the cost of maintaining it throughout the design life of the building. It is vital that asset owners keep this in mind; studies have shown that the cost of maintaining and operating a building is the most significant cost component over a 50 year design life.

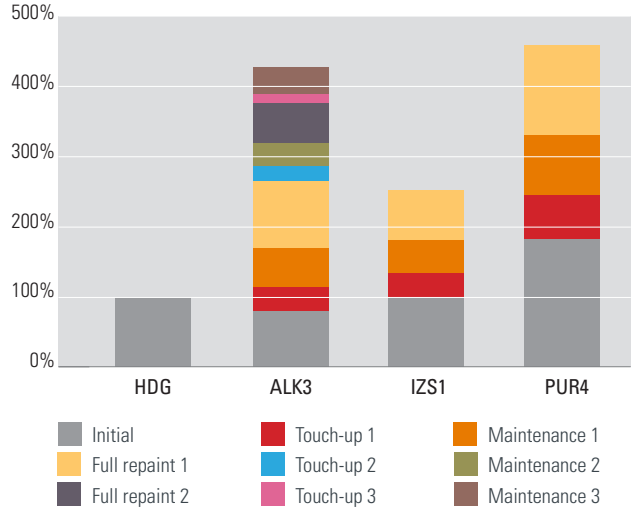
Figure 2: Indicative costs over the Life Cycle of a Building[2].



Using standard life cycle cost methods and the long-term NACE study on the cost of paints, combined with Australian Standards for durability of paint and hot dip galvanizing, the GAA compared the initial cost of galvanizing with common paint systems, estimating how these costs change over time.

The GAA based this study on a warehouse structure with steel exposed to a C3 (coastal or industrial) or urban environment, as usually encountered in Australia's major capital cities. The GAA also used the average life to first maintenance as per the relevant Standards for this environment.

Figure 3: Costs of common paint systems compared to a high performance galvanized coating on structural steel over 50 years.



[2] Life-Cycle Costing - Better Practice Guide, Australian National Audit Office, 2001.

ALK3

ALK3 from AS 2312.1 is typical of the relatively thin, inexpensive alkyd two coat systems that offer approximately 10 years of durability prior to the first major maintenance in a low corrosivity warehouse (C2) environment. ALK3 requires three cycles of maintenance to ensure the steel structure is sound over 50 years – even in a warehouse environment. As shown in Figure 3, this system is likely to cost nearly as much as a premium paint system over the design life of a building.

IZS1

IZS1 from AS 2312.1 is typical of a single coat zinc rich system, which is often compared to hot dip galvanized coating for price. IZS1 will last an average of 20 years before the first major maintenance is required in an urban (C3) environment. A full cycle of maintenance over a 50 year period will be required to maintain the integrity of the corrosion protection offered by the initial coating.

PUR4

PUR4 from AS 2312.1 is typical of a three coat high performance coating system that includes an aesthetic polyurethane top coat. PUR4 is almost twice as expensive (compared to hot dip galvanizing) at installation and increases in cost over time. These coatings typically require maintenance after an average of 20 years in an urban (C3) environment.

Other Considerations

Colour and Aesthetics

If specific aesthetics and colours are required alongside long-term corrosion protection, a duplex coating (galvanizing plus paint) is the perfect option. The GAA can recommend duplex coating systems delivered by all the major manufacturers which offer similar or improved durability to normal paint systems, as well as a cost-effective life cycle cost.

While Australian galvanizers are experienced in producing galvanizing that is suitable for duplex coating, the GAA recommends that asset owners discuss design requirements with both their painter and galvanizer prior to galvanizing. This will help ensure the most cost-effective outcome.

Some Australian galvanizers even offer a full-service duplex coating. Simply contact the GAA for further information.

Fire Protection

Hot dip galvanized steel can be overcoated with intumescent or vermiculite coatings using standard methods or with fire resistant board systems. This delivers fire protection standards that comply with all the relevant Australian fire codes.

Warranties

Most Australian galvanizers can provide a warranty for defects or durability. However, it is important to keep in mind that a warranty is likely to be voided if timely and appropriate maintenance is not undertaken, or if the structure is exposed to unreasonable conditions. To ensure cost-effectiveness, the GAA recommends that asset owners invest in a warranty of no more than one-quarter to one-third (12 to 16 years) of the expected coating life (50 years).

I'm convinced. I want to convert from paint to galvanizing. Where do I start?

There are usually only a few simple changes required to convert a design from paint to galvanizing. The GAA has technically qualified staff on-hand to assist with this process – all at no charge to you. We can also work with you to identify a suitable galvanizer, or you can choose one from our list of members.

CONTACT GAA VIA:
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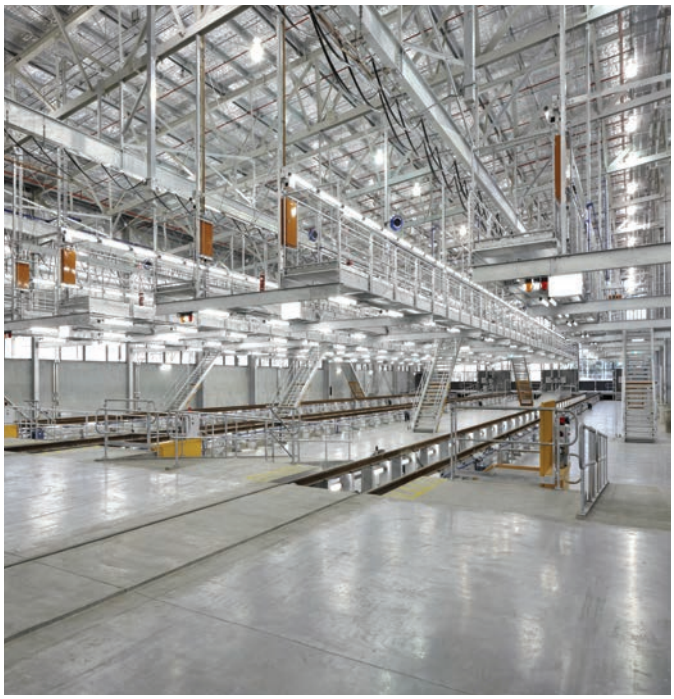
NEW DIGITAL APP GALVANIZE



Craigieburn Train Maintenance Facility (photography: Dianna Snape)

Hot dip galvanizing protects steel from corrosion by providing a thick, tough, metallurgically bonded zinc envelope, which completely covers the steel surface and seals it from the corrosive action of its environment.

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