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# LOCAL ENGINEERED SOLUTIONS

Four engineered solutions feature in this edition of *Galvanize*: two retaining walls; one in a new residential estate in the Northern suburbs of Melbourne and the other holding back the mighty Murray River at Moama; a waste water treatment plant in remote central Queensland and the sensational renovation of an iconic Katoomba tourist attraction.



## In this issue

- 1 Keeping steep task on track
- 2 Respecting the river withstanding water
- 3 Early treatment choice eases onsite wall choices
- 4 Protected parts keep flow steady for modular plant
- 5 HDG Gas Cylinders Underground Storage



Scenic World Katoomba

Some are multi-award winners and new icons in their region and all of them are examples of the benefits of using local engineers, fabricators and galvanizers.

While widely varying in value, location and complexity, these diverse projects have many elements in common including close collaboration between engineer, fabricator and galvanizer to ensure parts were delivered in-full and on-time.

It is in this way that Australian galvanizers contribute to compliance activities occurring throughout the steel supply chain; shoring up confidence in their ability to deliver efficiently to specifications, with proposed new codes of practice and construction categories linked to revised Standards, such as the major revision to AS/NZS 2312, *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings*, due for release later this year.

Other common elements of the featured projects include the ability of the local galvanizers to rapidly respond to changing customer needs, the advantages of hot dip galvanizing's hardness and durability compared to other coatings, initial and life-time cost benefits and the ability to design galvanized steel using modular construction to reduce assembly costs.

This issue of *Galvanize* also offers a short example of where the Galvanizers Association of Australia (GAA) has worked with local companies over a long period of time to develop and test an engineered solution for a unique local problem.

The GAA has technically qualified staff available for users of steel to assist with corrosion problems and offers free training on the use and application of hot dip galvanized steel.

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# KEEPING STEEP TASK ON TRACK



*Architect: PMDL Architecture & Design*



*Construction at Scenic World Katoomba  
(Project Manager: Jacobs (SKM), Managing Contractor: Grindley Construction)*



*Passengers at Scenic World Katoomba*

Close collaboration between the steel fabricator and galvanizer allowed the staged delivery of thousands of individual parts within a tight time frame for the extensive redevelopment of the world's steepest railway and permit the continual operation of Scenic World during construction.

Not only was it a requirement to ensure continuity of operations to the site's two other existing rides, but it was also required that the railway be constructed while the existing structure remained largely operational. The staged approach was essential to allow safe public access to parts of the existing platforms.

The physical size of items was not the greatest challenge for applying corrosion protection for this project, but rather due to the quantity and volume of steel being processed, the planning, staging and scheduling of each load of steel was critical and had to be done right to avoid any mix ups of steel sections relating to different stages of the project.

All up, the project called for 164 tonnes of hot dip galvanized steelwork for the popular tourist attraction located at Katoomba in NSW's Blue Mountains for new loading and unloading platforms and stairs for top and bottom stations, service walkways, bottom station towers, module walkways, equipment platforms and a balcony extension, totalling 17,855 individual steel components.

Nepean business, Galserv® was awarded the hot dip galvanizing by longstanding steel fabricator, Combell Steelfab with which the business has a long and close relationship, creating an ad hoc delivery plan spanning two months, focussing on quick turnarounds for full semi loads of material fabricated, galvanized and delivered to site on time.

Galserv® treated the support structures for the new upper and lower platforms and all stairways and maintenance access walkways, some of which were installed at an incredible incline of 52 degrees on the track leading into the Jamison Valley.

## The project recently won the Engineering Projects category of the Australian Steel Institute's Steel Excellence Awards and is an entry into this year's Galvanizers Association of Australia Sorel Awards.

According to the project's Account Manager at Galserv®, **Adam Chessell**, it was recognised right from the outset that the sustained short turnaround time was going to represent the greatest challenge for Galserv® to meet the fabricator's requirements.

"The average turnaround time was three days, but it was not uncommon to be given a call with specific items needing to be processed overnight or even on the same day," he said.

"The challenge was met by operating three shifts 24 hours a day, facilitated by the close understanding between ourselves and Combell forged over many years."

Not only that, he said the sheer mountain terrain meant access would make any rework extremely difficult and costly, so a low maintenance requirement was critical.



A Bell UH1H helicopter was required to handle the installation, with some sections even having to be lowered into place weaving through the complex web of the existing steel support structure, so having to reinstall components later on could prove costly.

"Hot dip galvanizing was the obvious solution providing a robust finish ideal for material handling during transportation which eliminated the need for expensive onsite touch ups," Mr Chessell said.

"The nature of the project demanded that the highest quality was maintained at all times but with the added pressure of very short lead times, so pre-planning was essential to ensure a relatively smooth flow of production," he said.

"The key was about knowing exactly what the customer needed and wanted at all times, achieved through regular consultation and a high degree of pre-planning.

"During the consultation, much focus was given to the design and fabrication to ensure the optimum finish and to eliminate all drainage and venting concerns allowing for a high quality finish every time.

"Stringent quality control was adhered to ensuring material was readily identifiable and traceable through accurate paperwork and materials lists.

"Delivering a consistent, high quality galvanized finish on time meant that the upgrade did not overly interfere with the operation of existing railway adjacent.

"Importantly, the galvanizing finish is aesthetically appealing in its surrounding environment and will remain so for years to come with the advantage of never having to have its coating reapplied.

"Clearly, the choice of galvanizing represented a logical fit-for-purpose and best overall solution for this world class tourist attraction with a long design life."

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# RESPECTING THE RIVER WITHSTANDING WATER



An engineered retaining wall supported by a galvanized steel frame is keeping land subsidence from encroaching on the picturesque Murray River and locals safe from floods whilst allowing red gum timber panelling to reflect the region's treasured tree life.

The project reclaims land that had subsided or eroded due to increased river usage but more so from damage incurred during the recent floods across the region on the NSW-Victorian border. The impact of the latest flood was substantial and endangered the safety of patrons who use the river side allotments at Maiden's Inn Holiday Park on the banks of the Murray.

The 333 metre long and four metre high structural steel and timber retaining wall at the Moama-based holiday park was designed to follow the naturally winding course of the Murray River and its undulating ground level whilst also providing a more secure foundation for the established river red gums along the bank.

Project Manager **Gavan Kennaugh** of G&K Kennaugh Earthmoving said the combination of large galvanized steel columns, horizontal rails and vertical red gum sections, all sourced locally using sustainable techniques, enhance the natural surroundings while providing a structure substantial enough to meet the required function.

G&K Kennaugh had previously constructed a marina at the complex, which redeveloped an existing lagoon to accommodate house boat mooring and vehicle access using similar materials, and was able to take a hands-on approach to imparting its knowledge of the terrain personally with the engineer, galvanizer and fabricator to ensure that the project ran smoothly.

It was decided the project would be designed and manufactured off-site to 'bolted together' specifications, including the red gum sections that were prefabricated in the workshop into panels, transported to site and lowered into place as the wall progressed upstream.

Mr Kennaugh said the galvanizing of steel components largely facilitated the prefabricated approach.

"The beauty of this bolted-together system was that no galvanized steel was exposed due to cutting, drilling or welding after treatment," he said.

"The post-to-rail connections allow for free drainage of moisture and no paint touch-up or repair was required onsite.

"It was delivered directly to site and close attention to detail resulted in an incredibly efficient installation time frame. The accuracy of the materials and workmanship ensured the structural retaining wall was completed well before the proposed completion date and importantly, before the river was due to rise."

He said durability was a key factor as the structure is expected to spend a substantial part of its life underwater, so galvanizing of the components was the only cost effective option.

The galvanizing work was carried out progressively between March and May 2013.

General Manager of Furphy Galvanizing, **Tim Doye** said they used the standard controlled process of solution pickling steel preparation just prior to molten zinc diffusion to achieve galvanized steel/zinc alloy layers in accordance with industry best practice.

Mr Kennaugh said the retaining wall has since become a place of interest for local visitors, especially those on board historical paddle boat cruises along the Murray. At the river's edge you can hear the onboard commentary explaining the importance of preserving the river bank and how important cultural heritage is in the region.

Construction of the retaining wall and beaching was completed ahead of schedule allowing a number of cabins to be relocated to direct waterfront sites whilst the banks were still dry.

**The GAA advises that the corrosion rate of zinc immersed in water varies with the influence of the water's type, pH and dissolved ions, amongst other factors.**

The corrosivity of water generally increases from hard water to soft water, seawater and distilled water respectively. The lower corrosivity of hard water is due to the presence of minerals (usually calcium carbonate) which help to form a film of insoluble compounds on the immersed galvanized coating. Most natural waters contain sufficient dissolved ions to prevent initial attack while the high amount of chlorides in seawater increases its corrosivity.

The rate of corrosion for zinc is relatively low within the pH range of 6 to 12. The immersion of galvanized steel in reasonably acidic or highly alkaline solutions is not recommended as the corrosion rate will be much higher.

Additional protection may be required in unfavourable waters or splash zones.

For more information about galvanizing for aquatic environments, visit: <http://www.gaa.com.au/index.php?page=performance>

# EARLY TREATMENT CHOICE EASES ONSITE WALL CHOICES

This project involved production and installation of retaining walls at the boundary lines around the new Spavin and Riddell residential estates in Sunbury on Melbourne's northwest fringe in Victoria.

Both projects comprise approximately 750 metre long timber retaining walls ranging from 200mm to 2.4 metre high supported by steel 'soldiers' and concrete footings.

The design called for some of the walls to be constructed off title as the existing land owners didn't want any of the retaining wall structures on their property.

This issue was addressed with specially designed offset fencing brackets welded to the back of the walls that enabled the retaining wall to be located inside the new property title but the fencing to be located on the title boundary.

This project and many more have been made to run a lot smoother with the assistance of Geelong Galvanizing's attention to detail and fabrication skills. Whenever materials were delivered to site, they were arranged into lots according to spreadsheet steel schedules supplied by Stringline, the contractor for the retaining walls.

Stringline General Manager, **David Walsh** said that it would have been difficult to sort out onsite without that guidance.

He said the design life for these walls was at least 25 years based on the use of treated pine sleepers, so the steelwork had to support that longevity.

The galvanized sections on this project were based on several types of steel soldiers employing sections of 150UC23 150UC30 and 250UC30 grades called up by the engineering.

"The reason for this is based on the height of the wall. The higher the wall the bigger the steel soldiers become to allow for the loading," Mr Walsh said.

"On this project we had different types of offsets for title boundaries so we had all soldiers fabricated off-site by the same company that undertook the galvanizing.

"We also had two different types of fence cleats welded to the tops of all steel soldiers before galvanizing. One type was fabricated on top of the steel soldiers whilst the other was to the rear for title offset."

He said the project was constructed at the very early stages of the sub-division works.

"This enabled us to have a clear run at all title boundaries and enabled the sewer contractors to work alongside the walls when needed," he said.

"By having everything prefabricated prior to galvanizing means we have the best protection for the steel.

"Having it all fabricated offsite also enabled us to safely bundle all steel into lots required so when delivered to site there was no need to sort or move around several times. That way there was less chance of damaging the galvanized coating."

**Jon King** as Operations Manager for Geelong Galvanizing agreed that prefabrication and surface treatment in the shop was a huge benefit for this type of project.

"Due to our previous experience and in-house capability we were able to provide a 'one stop shop' solution with our cutting and fabrication workshop that works alongside our blast and paint facility and our galvanizing plant," he said.



Part of the 750m long retaining wall



Offset fencing brackets were used to properly locate the fence on the boundary

He cited other benefits of this approach being a reduction in safety risks and longevity of the retaining wall due to no welding or cutting of steel required onsite in the less controlled building environment, leaving the galvanizing surfaces untouched.

"Because of the nature of the hot dip galvanized coating, no special transport requirements needed to be met reducing time and money as no special packing was needed to avoid damage," Geelong Galvanizing General Manager, **David Chaston** said.

"All sections were assembled and welded prior to galvanizing to ensure 100 percent protection and a maximum life for this product with the hot dip galvanized coating.

"Having the fabricator and galvanizer under one roof saved the client valuable time and money through reduced transport costs and reduced lead times, almost halving lead times on the project.

He said all galvanizing was carried out to Australian Standard AS/NZS 4680 and the fabrication was done to a strict quality regime in the production facility.



# PROTECTED PARTS KEEP FLOW STEADY FOR MODULAR PLANT

After a similar project using a 'stick built' approach proved to be inefficient, time consuming and labour intensive; Redispan Conveyors decided to employ a modular approach to design and build a functional 100 mega-litre per day water treatment facility in remote central Queensland, which proved a boon for the project in a location with minimal access.

The project was recently recognised with a High Commendation in the 'Engineering Projects' category of the 2014 Steel Excellence Awards for Queensland.

Redispan applied its design for manufacture and assembly (DFMA) approach through a major redesign of the facility structures. Using a detailed constructability study and early engineering engagement they considered transport, lifting and temporary bracing to move as much assembly offsite as possible.

Redispan Business Development Manager, **Greg Payne** said that being able to break the buildings into transportable sections fully fitted with piping, vessels, walkways and stairs had a dramatic impact on installation time and costs.

"The use of hot dip galvanizing for surface protection was also a significant factor in this type of work being able to be completed," he said.

"Galvanizing allowed joints to be trial assembled and separated without significant coating damage and the ability to eliminate expensive touch ups after bolting made the assembly process fast and efficient."

Mr Payne said that each section was reviewed early in the design phase to ensure individual items could be surface treated efficiently.

Industrial Galvanizers (Australia) Business Development Manager, **Alex Spillett** said that taking-over the work mid-way through the project was easily accomplished with galvanizing as the process is standard, although plant configurations and zinc bath 'kettle' chemistry may differ.

This is one of the strengths of hot dip galvanizing over other coating types; paint systems can differ dependent on the end-use of the steel, in which case taking over a project may require significant segregation of steel.

That was not the case in this project and Industrial Galvanizers were able to maintain continuous supply of treated steel so the project could be delivered on schedule.

## The use of hot dip galvanizing for surface protection was also a significant factor in this type of work being able to be completed.

Mr Spillett said that HDG really comes into its own on heavy duty modular structures such as these due to its resilience to knocks and scratches - particularly during transport.

"The galvanized finish is chemically bonded to the steel it protects, the thickness of the zinc-alloy protective coating being a function of the underlying steel thickness, its surface treatment and chemistry," he said.

"In terms of wear characteristics, the zinc-iron alloy layers are actually harder than the steel that it protects. This tough outer layer is resistant to abrasion and scratching, meaning chains and slings can be used to lift structures into place without the need for major repairs or coating of the steel afterwards."

"This is a real advantage with modular structures which are assembled onsite and usually craned or forked from the back of transport."

He said that with larger projects of this type, involving thousands of individual steel sections, Industrial Galvanizers allocates a single point of contact to coordinate scheduling.



*The water treatment facility under construction*



"We liaised regularly with the constructor and fabricator (sometimes the same company, but not always) and provided our operations team with a list of requirements for the following 24 hours and week."

"It is the coordinator's role to set up load lots for each truck, which they do in consultation with the yard supervisor."

With a stated design life for the facility structures of 20 years, Spillett added the HDG treatment provided well above the specified durability.

"Our Corrosion Mapping Model predicts a maintenance-free average coating life of at least 27 years for the HDG600 coating applied in the geographical location of the Water Treatment Plant," he said.

"The HDG steel is immune to UV attack – a major factor in mid-northern Queensland where the plant is situated - which could lead to premature failure of other coating systems."

The project called for many thousands of individual components to be treated, which varied in size and configuration; from large structural beams to lighter cross-members, stair stringers and handrails.

"The larger components were dipped individually using chains, whereas smaller items were hung together on jigs to increase throughput and productivity," he said.

He said that the Australian galvanizing industry has also treated similar projects located in more corrosive environments dealing with brine or salty air such as for the Sydney Desalination Project, as well as ocean projects for aquaculture in Tasmania.

# HDG GAS CYLINDERS UNDERGROUND STORAGE

LPG is a prominent resource, with numerous uses in both residential and commercial settings. End users want the assurance that the gas supply to their house or business will be continuous and trouble-free.

In locations that require the supply of LPG in cylinders, users also desire a storage solution which is practical and unobtrusive. Elgas' answer to these needs was to place the steel gas cylinders underground, where a durable and reliable corrosion protection method would be needed. After researching and trialling several possible solutions, hot dip galvanizing was chosen as part of the Elgas system to ensure corrosion protection for the cylinder's proposed 10 year service life.

**In locations that require the supply of LPG in cylinders, users also desire a storage solution which is practical and unobtrusive.**

In late 2006, the GAA began a long term study to monitor the performance of the HDG coating on two of the first cylinders to be installed. Over the past eight years, four inspections of the cylinders have been carried out.

During the most recent inspection undertaken at the start of 2014, it was clear the two monitored gas cylinders are both in excellent condition with no great signs of coating deterioration or loss of coating thickness. The appearance and coating thickness of the cylinders will continued to be monitored in years to come, with the prospect of extending their assured service life beyond 10 years.

A technical paper on the study was presented at ACA's Corrosion & Prevention Conference in late September. Contact the GAA if you would like more information on the project and performance of hot dip galvanizing in this underground environment.



## NEW DIGITAL APP GALVANIZE

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