GANZ
GALVANIZING ASSOCIATION

BRIGHT IDEAS

THE OFFICIAL NEWSLETTER OF THE GALVANIZING ASSOCIATION OF NEW ZEALAND

Welcome to the GANZ Newsletter

May, 2010

In This Issue

While it appears as though the recession is gradually lifting, it is too early to make any grandiose statements about growth. For the galvanizing community, the last twelve months were generally tough and while volumes did drop, businesses ensured that they were appropriately sized to cope with the reduction. Obviously we are hoping that the next twelve months will see a lift in volume as there is an abundance of latent capacity within the galvanizing market.

In this edition, we have an interesting article about Lion Breweries and its new brewing, bottling and warehousing development in East Tamaki. This impressive building was constructed by Mainzeal and utilised steelwork from D&H Steel. The building project aka Project Century used a number of galvanized products to ensure that the operation will only require minimal maintenance in the next 100 years. There was a real environmental focus in this project with recycled glass being used extensively and it was good to see that the fully recyclable galvanizing coating met the sustainable criteria.

To further illustrate the effectiveness of hot dip galvanized product, we have included an article which referring to a German study comparing paint coatings and a galvanized coating from a life cycle assessment perspective. The results are fascinating and reinforce our message that ‘Galvanizing may look silver, but is actually very green” .

There is also an article about the myths surrounding the welding of galvanized steel. We hope that after reading the article, you understand that it is not difficult to weld galvanized steel.

Lastly I would encourage you to look at the Millennium Bridge article. This is a fascinating case study of an iconic bridge in Auckland which did not have the most appropriate corrosion protection system specified when it was fabricated, eight years ago. It is heartening to see that the most cost effective system, over time, has now been applied to this landmark and we look forward to this structure having a useful life as it was intended.

Jonathan White
G.A.N.Z Chairman

Variation of Galvanized Coatings

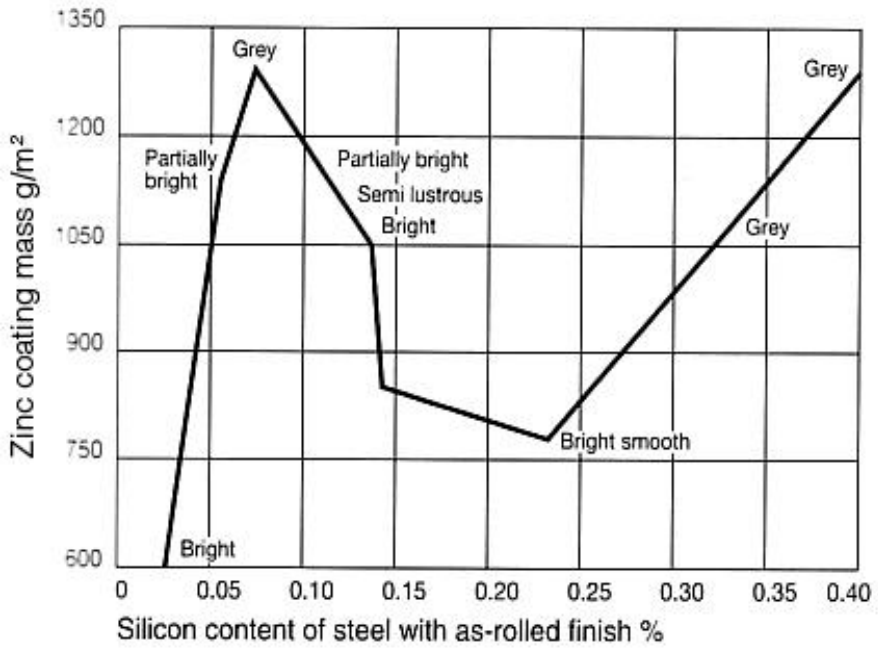
From time to time you may notice that there is a marked difference in the appearance of galvanized coatings ranging from good to lumpy and striated to dull grey. This variation can even occur in the same batch of steel. The photo opposite depicts galvanized tube and shows the variation that can occur due to the variation of the steel composition. Both silicon and phosphorous contents can have major effects on the structure, appearance and properties of galvanized coatings. In extreme cases, coatings can be excessively thick, brittle and easily damaged.

As shown in this graph, certain levels of silicon content will result in thicker galvanized coatings. These thicker coatings are a result of the increased reactivity of the steel with molten zinc and rapid growth of zinc-iron alloy layers on the steel surface. The graph

shows that such growth in coating thickness takes place on steels with silicon contents in the range of 0.04 to 0.14%. Growth rates are less for steel containing between 0.15 and 0.22% silicon and increase again with increasing silicon levels above 0.22%.

The presence of phosphorous above a threshold level of approximately 0.05% produces a marked increase in reactivity of steel with molten zinc and subsequent rapid coating growth. When present in combination with silicon, phosphorous can have a disproportionate effect producing excessively thick galvanized coatings.

If you are specifying steel that will be galvanized make sure the correct silicon and phosphorous levels are detailed so that a consistent surface finish is achieved.



Case Study: Project Century

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Project Century is the name given to Lion Nathan's new flagship brewery, bottling and warehousing development in South Auckland and it aptly describes the company's intention to create a facility that's built with a long-term future in mind.

Lion has embraced the opportunity to integrate a range of sustainable, environmentally conscious initiatives throughout the $250 million project to lower energy usage, cut greenhouse gas emissions, recycle and reduce water consumption, and re-use tonnes of waste glass material (See "A brewery built from beer bottles", pages 16 & 17).

From a construction perspective, the use of durable low-maintenance materials has been widely incorporated. This is evident in the large-scale use of galvanized steel throughout the complex where the exposure of external structures to the elements outside, together with high temperatures, steam, humidity, moisture and abrasion inside the brewery and bottling facilities will be constant factors.

Jonathan White, CSP Coating's General Manager, picks up the story, "Nothing matches hot-dip galvanizing for the long-term protection of steel from corrosion in harsh environments. When steel is immersed into a 450ºC bath of molten zinc, the zinc is metallurgically fused into the steel itself, becoming part of the steel's surface structure. These zinc-iron alloy layers are actually harder than the base metal. This immersion process completely coats every surface, including all the hard to reach internal surfaces and recesses. Zinc even has a unique property by which it offers a sacrificial protection effect to any areas where there may be coating damage. The uniform thickness of galvanized coatings provides a predictable rate of corrosion up to 1/80th the rate of uncoated steel."

Commenting on the sustainability of galvanized steel, White added, "The zinc used in the galvanizing process is 100% recylable and around 30% of the zinc in use worldwide today comes from recycled sources further adding to its suitability with this project's environmental focus. Like they say, galvanizing is silver and it's green. Plus, with the superior strength and proven long-term resistance to corrosion that galvanizing offers, the need for costly maintenance is greatly reduced, lowering the energy demands for the building, ensuring the galvanized steel plays a significant role in the project's sustainable construction and life-span."

White continues, "Mainzeal chose regular subcontracting partner D&H Steel for their expertise in fabricating structural steel sections designed specifically for ease of on-site lifting and installation. The roof trusses are an excellent example of this where D&H's installation knowledge ensured the trusses went in with the utmost efficiency. The same is true for the way Wayne Carson and his D&H team supplied us with expertly set up pre-fabricated sections for galvanizing.

They really understand the proper hanging and venting procedures for the hot-dipping process. Wayne stressed the premium nature of the project which required strict quality control. Prompt turnaround times often meant our Auckland galvanizing plant was working a seven day week. Several oversized sections needed specialized double-dipping in our 9 metre bath."

"In total we supplied more than 200 metric tonnes of galvanized structural steel and around 750 square metres of galvanized steel treadplate used exclusively on mezzanine floors throughout the 45,000 square metre packaging and warehousing building.
Obviously, the prospect of interrupting the bottling line with on-going repainting maintenance work would be costly and hugely disruptive, but galvanized steel is zero maintenance, so that sort of disruption's eliminated. Once it's done, it's done. It's there for the long-haul", concluded White.

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Using Life Cycle Assessments (LCA) to compare corrosion protection systems

When it comes to possible corrosion prevention systems for steel structures, the choice often lies between Hot Dip Galvanizing and paint. In addition to classical criteria for selecting suitable systems such as service life, functionality or costs, ecological considerations are also increasingly important.

A recent study by the Environmental Technology Systems Department of the Institute for Environmental Protection Technology at the Technical University of Berlin involved a comparison between a paint coating and hot dip galvanizing on the basis of a life cycle assessment.

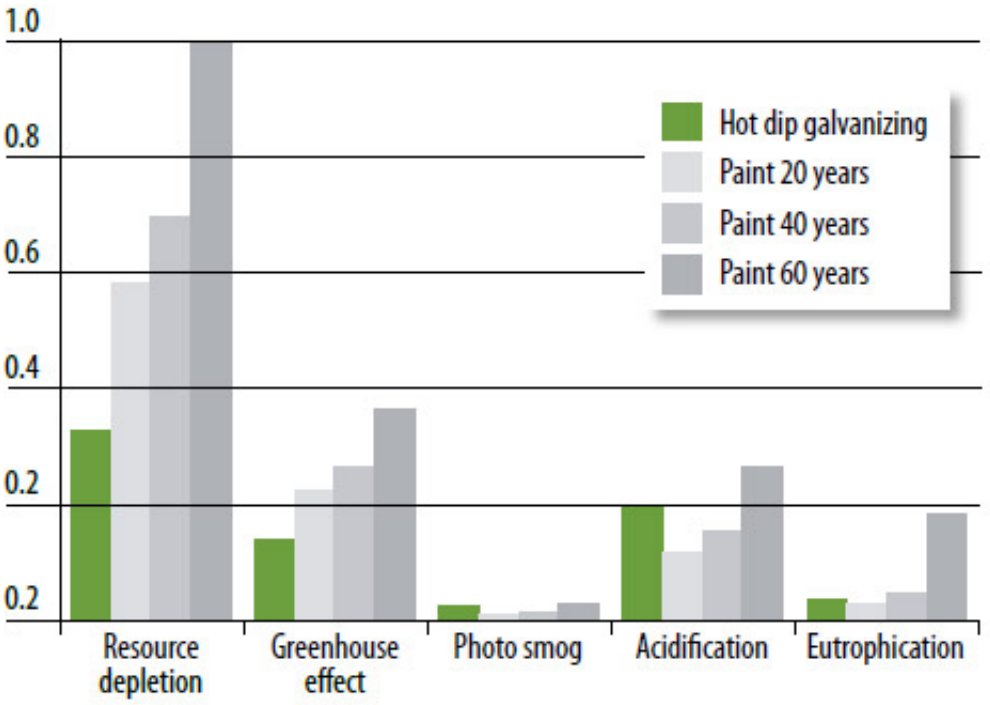
Comparative life cycle assessment

The ecological life cycle assessment is a recognised method which can be used to compare products or product systems in ecological terms.

It is based on the entire life cycle of the product, i.e. manufacture, use, conversion and/or disposal. This involves analysing all environmentally relevant substances which are extracted from the environment (e.g. ores, crude oil) together with substances which enter the environment (e.g. wastes, emissions) and listing them in a life cycle inventory. The inventory data is converted into a measure of the emission of greenhouse gases and the global warming of the atmosphere, which constitute the result of a life cycle amount.

Findings

The study shows that the life cycle assessment is a meaningful method, based on actual practice of ecological comparison of products. It brings out marked differences between two established corrosion prevention systems for steel structures. The hot dip galvanizing corrosion prevention system displays lower environmental impact for a steel structure with a long service life, as against a paint system. Long service life and freedom from maintenance, the well-known advantages of hot dip galvanizing, are the basis for the environmental benefits of the process.



Summary

Life cycle assessment (LCA) is a practical and scientific tool for ecological product comparison.
Hot dip galvanizing has big advantages for long life application and other studies show that over an even shorter lifetime of 40 or 20 years the results do not change significantly.

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Millenium Bridge: galvanizing the best solution

Opened in 2001, the Millennium Bridge is located at Mission Bay in Auckland. This pedestrian footbridge provides quick access to the beach from the waterfront promenade of Tamaki Drive. It's an award-winning creative collaboration between artist Virginia King and Chris Thom and was commissioned by the Auckland City Council to commemorate the new millennium at a reputed cost of $100,000.

Originally the structure was zinc spray coated, but this coating option proved to be inadequate in the corrosive marine environment. In 2008 the bridge was identified as needing a major renewal and the Council appointed Liz Yuda, an independent public artworks conservator, to oversee the restoration. In 2009 the footbridge was removed for remedial repair work costing around $70,000.

Liz described how the zinc spray coating was flaking off, especially around the joins, exposing the base metal to the elements. She contacted the Australasian Corrosion Association who advised that the best possible solution was a hot dip galvanized and painted duplex coating system.

The subsequent repair work to the bridge's railings and pillars was carried out at CSP Coating Systems' Auckland facilities. This involved removing the old zinc spray layer with grit blasting followed by acid bath dipping to strip any remaining coating in preparation for hot dip galvanizing. After being galvanized, the components were painted at CSP's industrial painting plant. This type of duplex coating treatment combines the effectiveness of galvanizing with an additional paint barrier to deliver optimum corrosion protection for even the harshest environments.

After a 3 month restoration, the much-loved iconic landmark is once again gracing the shoreline at Mission Bay. Given the proven performance of galvanizing, we will watch with interest to see how well the bridge's new coating compares to the original.

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Welding Galvanized Steel

There is something of a misconception that welding galvanized steel can be difficult. In fact, galvanized steels are routinely and successfully welded with ease using all the commonly practiced methods including gas metal arc, carbon arc, gas tungesten arc, manual arc and oxyacetylene welding.

Extensive industry testing has shown that sound gas metal arc welds and manual metal arc welds in galvanized steel are equivalent to those of sound welds in uncoated steel. Industry tests have also proved that the presence of zinc at the levels occuring in the weld metal does not affect tensile, bend or impact properties. The fatigue strength of arc welds in galvanized steel is equivalent to welds in uncoated steel.

Depending on coating thickness, porosity will occur in certain joint designs in galvanized steel due to volatilisation of the zinc coating and entrapment of gas in the weld. This has no effect on joint properties except in loss of fatigue strength. When joints are subject to fatigue loading, welds in galvanized steel should be made oversize to reduce the influence of any porosity in the weld metal.

Procedures for controlling the welding conditions of galvanized steels are also well established. Zinc vaporizes near the arc and oxidizes in the air as a non-toxic fine white zinc oxide powder. So, as with all welding, adequate ventilation and fume extraction should be in accordance with normal industrial practice. When welding in confined spaces, operators should wear suitable respirators.

Welding can damage the protective galvanized coating. Small exposed areas usually have little adverse effect due to the sacrificial cathodic properties of the surrounding galvanized coating. Larger damaged areas may require repair by the removal of welding slag with a chipping hammer, followed by wire brushing and the application of a protective coating. With manual metal arc welding and oxyacetylene welding of galvanized steel, the weld metal itself will corrode in most environments, so the application of a protective coating is essential. An organic zinc-rich paint is the most convenient and rapid method of repair. In some cases, zinc metal spraying may be used for coating repairs.

Welding galvanized steel is now a commonplace practice. Galvanized steel welds are proved to perform equally with those of uncoated steel welds. **Fabricators can have the flexibility of traditional welding techniques with the added advantage of superior corrosion protection that only galvanizing offers.**

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