

Stainless NZ

NEW ZEALAND STAINLESS STEEL DEVELOPMENT ASSOCIATION

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Global reach with stainless steel

Neil Dawson is one of New Zealand's most pre-eminent sculptors. A visit to Gibbs Farm sculpture park north of Auckland will put one of his giant, thoughtful sculptures – *Horizons* – before your eyes, as will a stroll in Cathedral Square in Christchurch where his *The Chalice*, a sculpture in the form of an inverted cone, takes pride of place. The experienced sculptor works in a variety of mediums, including mild steel and stainless steel.

Fanfare

In 2004, Neil was commissioned to create a mirror ball-like centrepiece for Sydney's New Year 2005 celebrations. His answer was *Fanfare*, a 20-metre geodesic globe with 360 turning pinwheels. Suspended from the Sydney Harbour Bridge, *Fanfare* was the stunning focus for light shows and fireworks to herald in the new year.

Broad appeal

Perhaps it is Dawson's lack of conceptual pretension that appeal most to a general audience. It is art that manages to dance on a tightrope between the populism of imagery instantly and universally recognisable from nature and experience, and the refined and minimalist look of high Modernism. And *Fanfare* with its turning, twinkling stainless steel pinwheels certainly fits this engaging balancing act. However, even before the sculpture



went up in its first role, suspended from Sydney Harbour Bridge, a poor early material choice nearly sabotaged the kinetic sculpture before its debut.

Oh-oh!

"Because I wasn't going to be building it myself," Dawson says, "I retained the right to disassociate myself from the project right up until the launch.

"However, the day before the launch I went down onto the wharf to look at the progress and, although the structure was looking really good, the fans had been made out of plastic – a mirrored PVC – and they weren't working the way we hoped for them to work.

"The press launch was the following day and I was there for only 24 hours, and I wondered what I was going to have to do, because the way it was, the fans were going to be blown all over the harbour.

You guessed it – stainless steel saves the day

"I went back to my hotel and over four hours worked out how the fans could be made out of austenitic stainless steel."

Dawson designed a way of making it where he could save half of the material by arranging the petals on a sheet.

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What lies beneath – stainless steel and underground structures



Whether it's tunnels, pipelines, supports or other underground structures – out of sight is not necessarily out of mind. Compromisation of these unseen elements through poor material selection can be disastrous – leading to failure of plant or equipment and all the labour costs and replacement material costs that go with it. So it's vital that the material selection process for such purposes is thoroughly robust.

Gauging the cost now and into the future

Life cycle costs (LCC) are even more important when selecting construction materials for underground structures than for those above ground. LCC look at the initial costs, operating costs including maintenance, and recycle value. Stainless steels are often perceived as an expensive option for engineering applications. However, LCC has shown that using stainless steel for critical engineering applications can help to minimise maintenance, downtime and replacement costs. Then there's stainless steel's famous recyclability. Essentially, the choice of stainless steel can save costs which far outweigh the initial higher material cost.

Reasons why – beyond corrosion

In the majority of structural applications SS is specified for its corrosion resistance. However other properties such as durability, mechanical properties, aesthetics, fire resistance and low maintenance all contribute. Good design should ensure that the grade of SS selected gives trouble-free performance during service.

Tunnels as an example – underground but still exposed

Designers are aware that some grades of SS can be subject to localised corrosion under adverse conditions in car or cable tunnel environments. The basic principles of material selection here take into account corrosivity of the service environment, the fabrication route, the surface finish required and maintenance of the structure.

It is important to always select a grade of SS that will have sufficient inherent corrosion resistance to accept an upset in normal service conditions without suffering some form of unexpected corrosion damage. Assessing the suitability of the grade of SS for fabrication of an underground structure is best approached by referring to past experience of using stainless steel in similar applications and/or environments. Consideration should be given to the SS grade mechanical properties, availability of product forms, ease of fabrication, surface finish, and the cost.

You get what you pay for

The specification of stainless steel alloys for underground applications is an extension of the calculated outcomes from applying LCC to material selection for an above ground structure. Choices are: either utilise lower grade materials with more frequent maintenance outages, or specify higher grade materials that require low maintenance and have a long service life. In recent years the trend towards ensuring the sustainability of infrastructure is factored in on engineering projects. Sustainability favours the option of choosing higher quality construction materials.

A spectrum of reasons to use stainless steel

The characteristics of stainless steel that meet the rigorous requirements for critical structural components in tunnel construction include: stainless steel does not emit toxic fumes at elevated temperatures; it retains a high proportion of its strength at temperatures in excess of 900 °C, if fire occurs; stainless steel requires no additional surface protection to resist the corrosive environments found in tunnels; it is available in a range of grades and various forms that provide long life with minimum maintenance costs.

From a recent presentation by Les Boulton, Nickel Institute Consultant New Zealand



Global reach with stainless steel

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Crisis what crisis ?

"I went to a crisis meeting re the situation and once they agreed to make the fans out of stainless steel, I was prepared to go along to the launch and associate myself with it.

"The use of BA (Bright Annealed) stainless steel for the fan blades was ideal for the mirror ball aspect of the brief, and the physical properties of the stainless steel were ideal for the rolling and machining of the pinwheels," says Dawson. "Durability was of prime importance."

The fans were constructed from 2.7 tonnes of austenitic stainless steel from 90 sheets of 10m x 4m x 1mm. They were fully tested in Christchurch including having one strapped to the front of a ute and driven at speed at Ruapuna Raceway at various angles.

In 2007, *Fanfare* was gifted to Christchurch by the City of Sydney. Now, re-engineered for permanence, it stands at the northern approach to the city – a legacy sculpture and symbol of renewal in the post-quake era.

City of sails, city of stainless



Repairs to Auckland's iconic Westhaven Marina involved cost-saving and highly innovative redesign solutions by Dixon Manufacturing.

The largest marina in the southern hemisphere, Westhaven forms an iconic part of not only the Hauraki Gulf, but also Auckland's City of Sails culture – being home to over 2000 boats and a vibrant marine industry in the heart of the city.

Given its importance and central location, Westhaven Marina was earmarked as an integral part of the Panuku Development Auckland (PDA) Westhaven Plan to improve facilities there. Ensuring the marina's existing infrastructure was up-to-date, safe, and able to cope with predicted increases in load and demand was imperative.

To complicate things, as the marina is a busy facility, the upgrade had to be delivered in a live environment with little disruption to users.

Stainless steel an enduring option

Traditionally the marina had utilised galvanised steel in its structures with its protective zinc coating making it corrosion resistant. However, in winning the job, Dixons Manufacturing was able to show that grade 316 stainless steel was a better option due to its high alloy (Cr, Ni, Mo) make up. As we know, stainless steel's protective passive layer is always in place, in comparison to galvanised steel's zinc coating which eventually corrodes away. Dixons assessment of 316 grade stainless steel was also backed up by detailed cost comparisons.

The company's consultation during the pre-production stage also led to some simple redesign elements that made a real difference in terms of the labour time involved – thereby minimising disruption to the public and allowing the firm to easily meet project deadlines through the phased delivery.

Change for the better

Jane Warren and Andrew Wilkes are co-directors of Dixon Manufacturing and Jane details here some of the design and specification choices that made the difference on the large upgrade project.

"We replaced the corner brackets that hold up the fingers and the pile guide rings from mild steel to grade 316 stainless steel, in some cases pickled or full electropolished. And we also make brackets to support the new boardwalks around the marina.

Complying with the best-use guide for 316 SS for safe performance, these marina elements were all for use above sea water level.

Slotted not bolted

"The slotting instead of bolting technique we came up with was for the triangular finger support brackets. The existing pattern had bolts and we found it was very time consuming trying to line up with existing bolt holes on the pontoons as nothing could be a perfect match for each replacement," says Warren. "Slotting the bolt holes meant the installers could replace the brackets in a minimum of time and get the job installed much more quickly."

Successes piling up

The company's success on Westhaven's promenade, Y and Z pier and pile mooring development are helping to ensure the marina can support future growth over the next 30 years.

"For us it was our first foray into this kind of work – we have been asked to quote for the work based on the quality and workmanship of our ladders – and this has since proved to be the beginning of a great relationship with most of the Marinas around NZ and some in Australia," Warren says.

Stainless steel & hospitals

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new surfaces. This study was specifically designed to assess effectiveness on both new and aged surfaces. In order to achieve this, a robust protocol to simulate aging and then to test the effectiveness of disinfection on both new and aged materials was developed. A significant proportion of the study was devoted to creating this protocol to ensure consistent, objective and repeatable results.

Most commonly used grades tested

A cycle of fouling and cleaning was developed to simulate aging, after comprehensive research to select the most appropriate fouling solutions, disinfectant and cleaning methods. Samples of two grades of stainless steel most commonly found in hospital environments – AISI 304 and AISI 316 – were sourced with four and three different surface finishes, respectively.

Both new and aged stainless steel samples were then contaminated with two types of bacteria which cause the majority of HAIs – *Staphylococcus aureus* and *Pseudomonas aeruginosa*.

Staphylococcus aureus is the most pathogenic of the *Staphylococcus* genus and is responsible for food poisoning and suppurative localised infections, and can in extreme cases prove fatal. *Pseudomonas aeruginosa* is very prevalent, highly resistant and one of the most difficult to treat.

Both sets of stainless steel samples were then cleaned in accordance with the protocol, and assessed for remaining levels of bacteria.

Good news story on both counts

The efficiency of disinfection was measured and recorded and the disinfectant was 99.9% effective against *Staphylococcus aureus* and 97.6% effective against *Pseudomonas aeruginosa* after five minutes contact.

Importantly, there was no discernible difference between the efficiency of disinfection across the range of grades and finishes and whether or not the stainless steel was new or aged.

Industry Profile

Paul Gapper



Paul Gapper studied at Massey University in Palmerston North for a Bachelor of Technology majoring in Industrial Management and Engineering. Fresh out of the university gates, he started at NZ Fasteners, Hamilton, in 1979. At that time, the Waikato was the foremost region for stainless steel fabrication and usage, giving him a great introduction to the industry.

Career path

Over the years, Gapper's career path has led him to a variety of roles from product manager to administration manager in both Australia and New Zealand, fitting in travels to Europe to visit a number of stainless steel mills, producers, and stockists along the way. Most recently, in 2016, Gapper joined Stainless Products – a smaller private specialist stainless steel company – where he's currently involved in both sales and purchasing.

Gapper has been a member of NZSSDA for many years, both as a personal member, and representing various firms, including NZF Stainless, Sandvik / Vulcan, and now Stainless Products. His broad experience has given him some great insights.

Enormous potential

"I believe there's enormous potential to use NZSSDA as a means to developing the work skills required throughout our industry – both from a sales-distribution perspective, but more importantly at a fabrication and specification level.

"There's a disturbing trend where project and consulting engineers have little or no specialist knowledge or experience of stainless steel and recent project material specifications have highlighted this issue. I am regularly talking with customers struggling to get clear and accurate specifications for project material tenders."

In the past, Gapper has also been a member of the NZIFST, plus attended Dairy NZ as well as Pulp and Paper conferences where stainless products and specifications have been discussed – including the early development of the Blue Book.

NZSSDA an important educator

He sees opportunities for NZSSDA to work more closely with such organisations to promote a better understanding of stainless steel and its potential. Plus there's a real need for engineers and specifiers to consult with the NZSSDA prior to completing designs and material specifications.

"The future for stainless steel continues to be extremely positive for our country – not only in terms of food production and processing, but also for water management and in architectural and structural applications where due to our climate and coastal living, its long-life and aesthetic properties offer major advantages.

Just do it!

"So I would encourage new people to consider entering our industry in any role – fabrication, machining, engineering or distribution. The technical aspect to our product allows people the opportunity to continually learn more about it, and challenge their skills. In addition, the pioneering generation from the '60s and '70s are moving towards retirement and we run the risk of losing a wealth of practical industry knowledge. Stainless steel is more than a special subset of carbon steel – it is a standalone material and industry in itself.

We are connected

"The longer you remain involved with stainless steel, and in particular distribution, the more you realise that even being based as far away as New Zealand, the stainless steel world is very small. I have met people in the industry in Asia, Europe and the US and it is amazing how often you all know the same personalities in other markets. I believe that there is an incredible bond and wealth of knowledge that you can tap into once you are committed to our special metal. Being 100% recyclable means that we can proudly and confidently promote any increased usage of stainless steel."

Stainless steel and hospitals – keeping us safe from harm

The World Health Organization lists Healthcare (or Hospital) Acquired Infections (HAIs) as the most frequent adverse effect in healthcare delivery, affecting hundreds of millions of patients worldwide every year. HAIs are defined as infections affecting patients in a hospital or healthcare facility which were not present or incubating at the time of admission.

Bacteria clings on

In operating theatres, intensive care units and other areas where infection control techniques and hygiene are at their highest, the risk of HAIs is very low. However, the very strict procedures adhered to in these areas are unsustainable across an entire hospital or healthcare facility. Therefore bacteria are commonly found in patient areas such as hospital rooms and wards. Some bacteria can survive for several weeks and can be spread to other patients through day-to-day contact and ordinary activities. A study in 2004 identified microorganisms in patient bathrooms and showers, and on beds, tables, handrails, walls and floors.

Growing antibiotic resistance makes disinfection even more vital

In the context of growing antibiotic resistance, it has never been more important to ensure that surfaces and objects in all patient areas can

be easily cleaned and disinfected. Stainless steel has played a key role in clinical safety in hospitals for many decades. It is chemically inert, non-toxic and can be manufactured into smooth, non-absorbent surfaces which can be thoroughly cleaned, disinfected and sterilised safely without degradation or corrosion.

Comprehensive study of cleaning old stainless steel and new

Manchester Metropolitan University and AgroParisTech were commissioned to devise and conduct a study to examine the disinfection of stainless steel for use in hospitals.

Most of the existing research to assess the effectiveness of biocides and disinfectants has been carried out on



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