

AUSTRALIAN STAINLESS

SPECIALISING IN STAINLESS STEEL AND ITS APPLICATIONS

#50
SUMMER
2011/12

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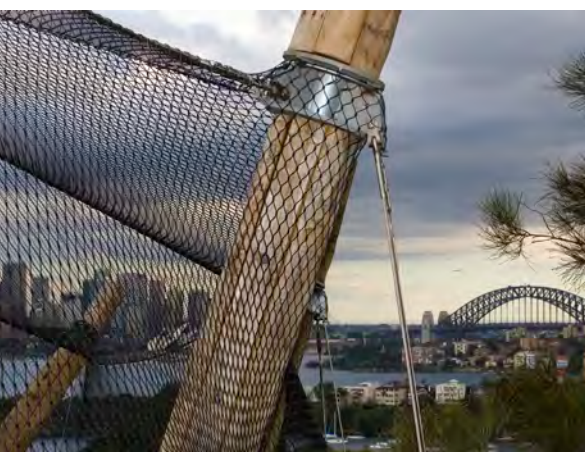
ASSDA

CHIMPANZEE SANCTUARY

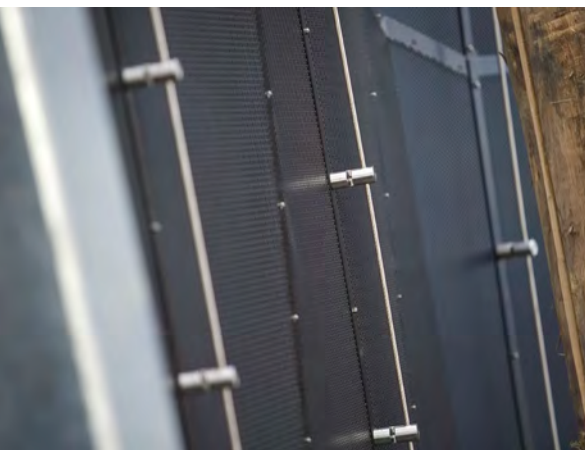
WHERE STRENGTH MEETS STYLE



1. Non-climbable wall from paddock



2. Enclosure - blackened stainless steel mesh



3. Non-climbable wall - stainless cable net and panel supports



4. Chimpanzees enjoying their new home

Innovation in zoo enclosure design is a key feature of the recently completed \$7.5 million makeover of the Chimpanzee Sanctuary at Sydney's Taronga Zoo.

The project brief was to create a chimpanzee habitat akin to their native home that would encourage social interaction and allow the zoo's primate keepers to manage animal husbandry and the group's changing demographic. The enclosure's transparency and the ability to withstand the chimpanzee's remarkable strength and intelligence were essential.

ASSDA member Ronstan Tensile Architecture was contracted by the builder, the Lipman Group, to be the specialist contractor for the technical design and installation of a mesh enclosure and non-climbable wall. Ronstan's unique capability in tensile architecture and their technical expertise were a natural fit for this challenging project designed by Jackson Teece Architects.

The Sanctuary features the mesh separation paddock (similar to an aviary), at one end of the main exhibit. A non-climbable wall with a removable curtain, allows both spaces to function as one large paddock. This enables introductions of new chimpanzees into the compound and helps manage the apes' complex behaviour patterns.

Ronstan Tensile Architecture's General Manager, Rowan Murray, said the non-climbable wall structure was one of the most challenging design aspects.

"The architect's greatest challenge was to separate the chimpanzees physically, but still have them all in view in the paddock. We had to build a wall that was transparent, had openings of no more than 5mm to avoid chimpanzees putting their fingers in and climbing, and could withstand the strength of chimpanzees." Mr Murray said.

The structural complexity of the non-climbable wall required 3D modelling to analyse design configurations and ensure structural integrity. Test panels of the non-climbable wall were fabricated and assessed in the chimpanzees' temporary enclosure to determine which would offer the safest containment of the site and minimise visibility.

Mr Murray said the primary structure for the wall consists of a Ronstan supplied tensile cable net that supports semi-transparent perforated stainless steel panels.

"Most materials can be damaged, but the durability of stainless steel panels of certain perforation proved to be the right solution and important in the development of the overall design," he said.

"The non-climbable wall had been designed with wall panels clamped directly to the enclosure mesh face. In a collaborative effort, we changed this to an independent cable net structure to remove the risk of having the final wall shape differ from that modelled, and in doing so, avoided the risk of panel geometry differing from the complex 10 degree incline necessary for non-climbability. This also ensured uniform set out and fixing methods, more consistent panel shapes and allowed the panel geometry to drive the wall structure rather than this being determined by other elements."

ASSDA member, Locker Group, supplied the grade 304 stainless steel panels, which were perforated to 50%. A black painted finish was applied before installation.

With stringent performance characteristics to adhere to, including long-term corrosion resistance and aesthetics, Carl Stahl X-Tend stainless steel mesh was specified for the separation enclosure and the removable curtain within the non-climbable wall. The stainless steel mesh was blackened using an electrolytic process to increase transparency of the enclosure.

Trevor Williams, Lead Consultant of Jackson Teece and Project Architect for the development, said materials selection was critical in delivering the aesthetic appeal and longevity of the enclosure.

"We spoke with Ronstan Tensile Architecture for technical design advice in the early stages of the project. There were various other types of meshes that were a possibility but, being a dynamic structure, alternate materials were far too rigid and not as flexible as the Carl Stahl X-Tend stainless steel mesh. I don't think we could have achieved this outcome with any other mesh," Mr Williams said.

"The stainless steel will have a longer life in the aggressive south-facing coastal environment. The blackened mesh has a fantastic form and from an architectural point of view, has achieved an organic appearance."

Ronstan Tensile Architecture's contribution to the project, including the tensile mesh enclosure and non-climbable wall, cost about \$1.2 million and took 16 weeks to construct.

Mr Murray said the stainless steel demonstrates a great mix of strength and transparency, and the end tensile result is very forgiving.

"Achieving the architectural intent involved complex modelling and finite analysis of the mesh form to ensure the surrounding structures could be designed to support the enclosure loads. Ronstan is absolutely rapt with the state-of-the-art structure," he said.

The paddock was completely re-landscaped and the impressive exhibit also now features several climbing platforms at varying heights of up to 12 metres, and a 180 kilogram hammock for the chimpanzees to enjoy.

The 17 lucky Taronga Zoo chimpanzees moved in to their renovated home in late September 2011.

Images 1, 2 and 3 courtesy of Ronstan Tensile Architecture.

Image 4 courtesy of Taronga Zoo.

QUANTITIES AND GRADES OF STAINLESS STEEL USED

› Mesh enclosure

770m² of 3mm Ø x 60mm blackened stainless steel, grade 316 Carl Stahl X-Tend mesh.

› Non-climbable wall facade

140m² of grade 304 stainless steel perforated to 50%, with a black painted finish.

› Cables

1x19 construction 8mm, 12mm and 22mm diameter, grade 316 stainless steel cables. The stainless steel cable end fittings and components were polished and passivated prior to installation.

HELICAL COIL GETS A U-NEEK BEND

Fabricating equipment for the chemical sector requires solid high quality materials and superior workmanship. In April 2011, ASSDA member and Accredited Fabricator U-Neek Bending Co Pty Ltd put the finishing touches on a radiant helical coil at their factory in Dandenong, Victoria.

The coil, designed as a heater for Titanium Tetrachloride (TiCl₄) production, is 11.4 metres long with a diameter of 3.05 metres and required more than 7 tonnes of high grade Inconel Alloy.

U-Neek's Business Development Manager, John Lovell, said the client chose to have this material shipped from America.

"At around US\$1000 a metre, Inconel Alloy is a very expensive option but it has great heat transfer properties and is completely non-corrosive," Mr Lovell said.

The Western Australian client, who declined to be named, were looking for a fabricator that, in addition to having a proven record in metal bending, could work to their particular requirements for this critical process component.

"U-Neek weren't just competitive in pricing," said Greg, a project engineer with the client. "They succeeded with all the trial projects we sent them."

"To ensure total quality control, we provided a comprehensive report that detailed every step of the process, including the names of every person who worked on the individual stages," Mr Lovell said.

U-Neek Engineer Dale Theobald said the coil was manufactured to exacting tolerances using a range of Inconel Alloy materials.

"We used 150NB Schedule 40 seamless 600 for the pipes and flanges, 366-04 WPNCI-S for the elbows, B168-08 for the plate and 253MA for the high temperature pieces," he said.

Once completed, the coil then had to undergo a rigorous series of tests. The butt welds were verified with full radiography, the attachment welds were submitted to liquid penetrant inspection (LPI), and a full hydro exam was done on the coil itself.

"The coil was filled with distilled water to test its heating capabilities. Then the coil was pressurised with nitrogen, to a dew point of -12°, to remove all traces of water and moisture prior to transporting," Mr Lovell said.

The transport frame and mounting jigs were manufactured from mild steel. To ensure no cross contamination, Inconel

strips were fitted to the mounting points. The coil was lifted onto the back of a semi-trailer for final transportation to Perth, using U-Neek's 16 tonne travelling overhead cranes.

Images courtesy of U-Neek Bending Co Pty Ltd.



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THE SUSTAINABLE SCORE CARD FOR STAINLESS STEEL

The greatest challenge we face is the control of our own success. With 7 billion people on earth, all with an insatiable appetite for a high standard of living, the newest dimension of materials competition is sustainability.

Sustainability is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UN World Commission on Environment and Development, 1987). In real terms, that means making choices that do minimum damage to our environment, but support a high level of human development.

The built environment is an excellent place to start. Buildings last for a long time, locking up the energy used in making their materials, requiring maintenance and consuming the energy used for heating and air-conditioning. They consume a large proportion of our resources. The choice of materials affects all 3 aspects of consumption, and, a number of building evaluation systems have been created around the world to assist in rating buildings for sustainability. Materials are scored for their energy content reuse during major refurbishment, waste management, recycled content and contribution to the overall design and running costs.

The Green Building Council of Australia rates green buildings for sustainability. The pace of registration and certification is increasing. Of the 368 certified projects, 96 were certified in the last 12 months. The push towards sustainable development in the building sector is strong and accelerating. City of Melbourne's Council House 2 (CH2) is Australia's first Green Star rated building to be awarded 6 Stars, which carries an international leadership status. Stainless steel was used to support screening walls of living green plants that shade the building and, required no maintenance or painting, working with the environment to keep good working conditions. Such membranes, containing plants or actively or passively screening the sun, allow the use of a smaller capacity air-conditioning plant, with lower capital costs and ongoing running costs and energy demand.

The only Gold LEED® (Leadership in Energy and Environmental Design) certified meeting venue in the world is the Pittsburgh Convention Centre in the United States. Its grade 316 stainless steel roof is used to harvest rainwater, reducing water demand on the city system -

another example of the special properties of stainless steel.

Stainless steel roofing and rainwater goods give extremely low levels of run-off. See *Table 1*. But this is not the only reason to use stainless steel in the built environment. It contributes to sustainability because of its long service life, excellent corrosion resistance, clean and unchanging appearance and its exceptional hygiene characteristics. Stainless steel is reusable, entirely recyclable, and probably the most recycled product in the world. On top of that, it needs very little cleaning or short or long term maintenance, and makes no contribution to indoor pollution as materials emitting volatile organic compounds (VOCs) do.

There is considerable history and experience of stainless steel service life in the built environment. The Chrysler Building (1930) and Empire State Building (1931) in New York demonstrate the

material's durability, excellent appearance and resistance to corrosion. This extraordinary functionality has been played out many times with a number of examples here in Australia, including the Fujitsu Building in Brisbane, which is clad with 445M2 ferritic stainless steel. Located in a marine industrial environment, this building looks as good as it did on completion in 2002. The long life of stainless steel in these atmospheric applications shows its very high corrosion resistance. The corrosion rate of grade 316 for instance in most atmospheres is more than 5000 times slower than the rate of carbon steel. See *Figure 1*.

There is a considerable industry devoted to the collection and recycling of stainless steel products at the end of their life and, scrap is the standard feedstock for making stainless steel. In any stainless steel object, there is an average of 60% recycled content. New production would virtually all be made from recycled stainless steel if it were available, but the

TABLE 1 RUN-OFF STUDY IN STOCKHOLM

		AVERAGE RUN-OFF mg/m ² /YEAR
Zinc*		2,800 - 3,000
Copper		1,300 - 2,000
Stainless steel 304^	Nickel	0.30 - 0.40
	Chromium	0.25 - 0.30

* Zinc sheet and galvanised carbon steel.
^ Nickel and chromium were not detected in many samples. Average concentrations were well below NOHSC Drinking Water Guideline.
Source: I.Odneval Wallinder & C.Leygraf, ASTM STP 1421, 2002.

TABLE 2 METALS COMPARED

METAL	RECYCLED CONTENT	END OF LIFE CAPTURE
CARBON STEEL		
Integrated mills	25-35%	70%
Mini mills	>95%	97%
STAINLESS STEEL	60%	>80%
ZINC	23%	>80%
COPPER		
Electric wire	0%	>90%
Other products	70-95%	
ALUMINIUM		
Sheet	0%	
Extrusions	Varies	70%
Castings	~100%	

Source: C.Houska, 6th European Stainless Steel Conference, Helsinki, 2008.

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For more than 20 years, Balustrading WA has been servicing the renovation and building industries, delivering solid advice, unsurpassed service and innovative designs to meet the most unique requirements. The company takes care of the entire process, from design, manufacture to final installation. Specialties include balustrading, stair cases, pool fencing, regular fencing and gates, offering both custom and standard designs in glass, stainless steel and aluminium. Offering durable products, Stainless Steel offers clean lines and is proving to be the architect's choice for combining leading edge design with durability. Balustrading WA offers products manufactured from Marine-grade 316 stainless steel.

growth in the use of stainless steel and its long life in service limit the supply. *Table 2* compares the recycled content and end of life capture rate of the industrial metals, and demonstrates that stainless steel is the most recycled industrial metal.

Sustainability is about much more than recycling. The energy used to make the material has a direct impact on sustainability, and all metals are energy intensive. Energy is a scarce resource, generates greenhouse gases and creates specific demands on land use likely to impact on future generations. Longevity and extraordinary recyclability will not be helpful if stainless steels' energy consumption is much higher than other materials. *Figure 2* describes the embodied energy in terms of CO₂ equivalent for some of the industrial metals, and shows that stainless has a comparatively high level of embodied energy. In kilogram of CO₂ per kilogram of metal, the austenitic grades are over double the footprint of carbon steel, although the ferritic grades are a little less. The footprint of stainless steel is caused by the production of alloying elements nickel and chromium, which are needed to give stainless steel its special properties, including extremely long life. Even so, efforts are ongoing in the stainless steel industry to reduce the energy content.

But in the real world, kilogram CO₂ per kilogram metal comparisons are misleading. Take a typical application; a box gutter on a building. The metals have different strength, so are used with different thickness. Stainless steel gives a relatively light weight gutter (see *Table 3*), and hence the lowest footprint as installed. Coupled with its extended durability without maintenance, stainless comes out as the most sustainable option. Painted galvanised or Zinalume® coated carbon steel has not been included in the table as the calculation of the contributions of the components were too complex, but these materials are highly unlikely to beat the sustainability of stainless steel, even as-installed, and they have a much shorter life.

In summary, stainless steel has excellent recyclability, energy content as-installed (at least as good as other metals), extraordinary longevity and next to no need for maintenance, ever. Add to that the benefits of their special properties, which allow for the construction and operation of buildings at a lower cost. The contribution of stainless steel to sustainability is obvious and considerable.

This article was prepared by ASSDA Technical Committee member, Alex Gouch from Austral Wright Metals.

TABLE 3 SUSTAINABILITY FOOTPRINT - SAA HB39 BOX GUTTER

METAL	MIN THICKNESS mm	DENSITY kg/m ³	WEIGHT kg/m ²	kg CO ₂ /m ²
Zinc	0.7	7,130	5.0	13
Copper	0.55	8,960	4.9	20
Aluminium	0.9	2,700	2.4	29
Stainless steel - A	0.45	8,030	3.6	18
Stainless steel - F	0.45	7,950	3.6	14

FIGURE 1 LIFE COMPARISON

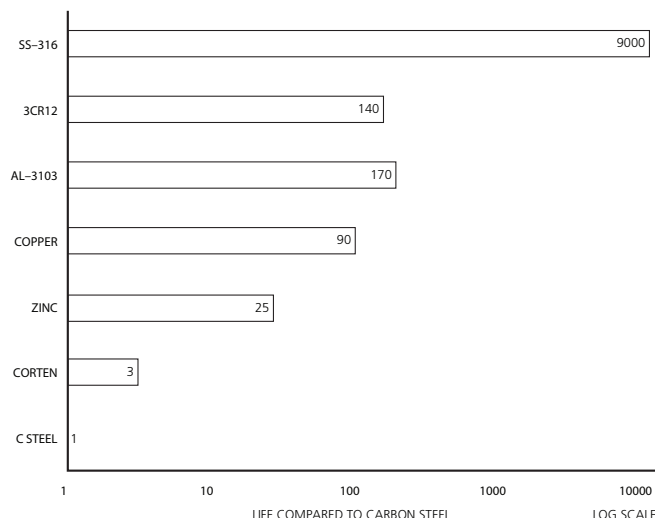
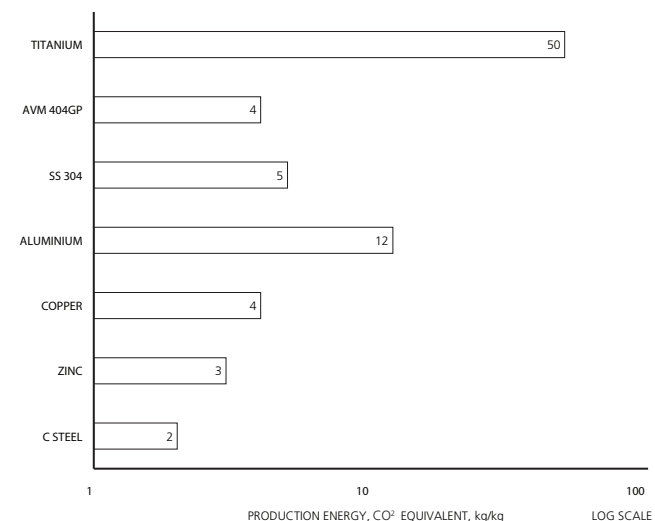


FIGURE 2 SUSTAINABILITY FOOTPRINT



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Images above and below: Westfield Sydney interior



REFLECTED GLORY

Stainless steel's star has ascended in the public's conscience as thousands of Westfield Sydney shoppers enjoy the world-class design and materials on show in its newest retail development.

Covering 103,000m², the \$1.2 billion Westfield Sydney development is bound by the Pitt Street Mall and Market and Castlereagh Streets in the heart of Sydney's CBD. It integrates Westfield Centrepoint, the Centrepoint Convention Centre, Imperial Arcade and Skygarden, plus a new office tower at 85 Castlereagh Street and an extensively modified and refurbished tower at 100 Market Street.

While the size of the project is enormous, it's the design that's turning heads. With a nod to lauded international developments in Paris and Frankfurt, the architects of Westfield Sydney have created a stunning environment that makes extensive use of mirror and hairline finished stainless steel in the interior spaces.

Stainless steel was chosen by Westfield's architects to create a very upmarket, stylish environment for shoppers. In addition to meeting the design intent, stainless steel also offers durability and ease-of-use during construction.

ASSDA Accredited Townsend Group was chosen to design, fabricate and install stainless steel elements throughout the complex, a task it was confident to undertake due to its experience delivering exceptional quality products to exacting clients, such as Apple Inc.

Townsend was awarded the following elements using only 316 grade stainless steel:

- › 8,500m² of mirror-finished stainless steel troughs and particle board infills in the feature ceilings on levels 3 and 4
- › Composite stainless steel panel cladding of the escalators on all levels
- › Black glass and mirror-finished stainless steel on the escalator soffits in void 4
- › Hairline-finished stainless steel composite panel cladding in voids 1 to 10
- › Mirror-finished stainless steel cladding of the elliptical column in void 1 from levels 1 to 5.

The project's innovative design and engineering required the use of Townsend's Vee-Cutter, the only one of its type in Australia, to create a very tight radii on the corners on some of the architectural elements. No additional services or treatments were required before or after installation as the stainless steel was procured with a protective film that remained on the product through the manufacturing process until the installation was complete.

Townsend Managing Director and CEO Russ Hill stated that the company was excited when selected for this prestigious development. The complexity of the project presented many challenges which Townsend was able to meet through its skill and experience, resulting in a finish which met the brief set by Westfield and its architects.

Images courtesy of Townsend Group.

STAINLESS AFLOAT SYNERGY OF LIGHTNESS AND STRENGTH

Artist Wendy Mills' interest in an ancient Sumerian myth helped bring her vision to reality for a stainless steel sculpture at Willoughby City Council's new cultural centre.

Described as the cultural home of the North Shore, The Concourse (Chatswood, NSW) incorporates a concert hall, theatre, library, outdoor urban screen, restaurants and retail stores.

Council worked through Pamille Berg Consulting to commission Ms Mills to create an artwork for the library's water court, which is located below ground level. The 6.1m sculpture, fabricated by

ASSDA Accredited Fabrications Australia, is visible from above as well as from within the library.

Fabrications Australia fabricated the sculpture from 50mm x 50mm x 3mm square hollow sections of grade 316 stainless steel and applied a mirror polish. The joins were TIG welded and carefully ground smooth to ensure a high quality finish.

The sculpture is mounted on a 'blade' made from 12mm grade 316 plate that was painted to reduce visibility within the water, so the sculpture appears to float on the surface. As the support structure

(story continues on page 7)

is bolted into the floor immediately above a carpark, extensive water proofing was required.

Ms Mills said the sculpture was more than 2 years in the making from when it was first conceived. Fabrications Australia and Consulting Engineer, Bernie Davis from Opus, worked together with her design to overcome challenges such as the structural support and ensure a proper balance of geometry, constructability and aesthetics.

Mr Davis said it was the team focus on this total balance that ensured a happy client.

Fabrications Australia Director Shannon Molenaar said the project was a true collaboration that evolved over time. Key issues for the fabrication team were structural integrity and long-term durability.

Ms Mills said she chose to work with stainless steel because no coatings were required. She wanted a mirror finish as it requires very little maintenance and it reflects the environment, making the artwork seem lighter.

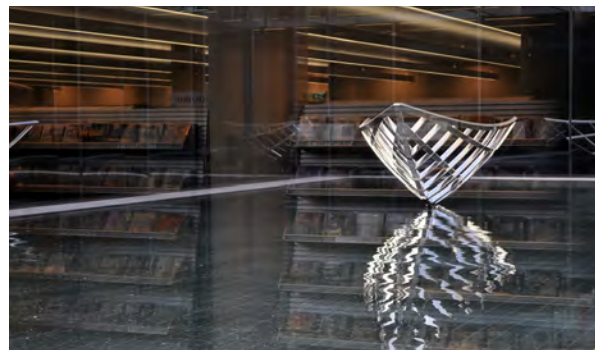
For this piece, she envisaged a form of transport halfway between a plane and a boat that would sit lightly on the surface of the water as if it is about to

take off, yet from above it would appear like a winged insect that has just landed. Her goal was to create a 'stillness' – a space for reflection, transition and transformation.

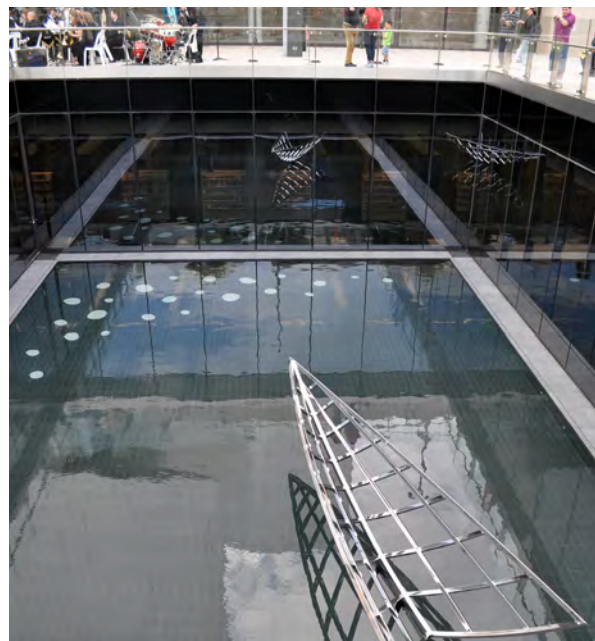
She said her initial concepts of a sky boat and transition tied in beautifully with the Sumerian myth of Inanna and the location within the library water court in the cultural precinct. According to the myth, Inanna (the queen of heaven) travels in her sky-boat to visit Enki (the lord of wisdom) who lives in a watery abyss and gives Inanna divine decrees to transform her city into a new centre of civilisation and culture.

The end result of this successful collaboration is an artwork that purveys a sense of peacefulness while showcasing the versatility and durability of stainless steel in a water environment.

Images courtesy of Wendy Mills.



Boat sculpture: view from within the library.



Boat sculpture: view from above.

BREWERY TO EXCEL WITH LOCAL FABRICATION

A worrying trend among Australia's major resource companies is the increasing amount of engineering, detailing and fabrication work being sent offshore - a move that has had significant impact on local fabrication. But there are some positive signs in the food and beverage sector that local fabricators are more than capable of meeting design and fabrication expectations.

When ASSDA member and Accredited Fabricator, A&G Engineering, put in a bid to build 10 x 100 hectolitre beer fermenters for Casella Estate - a company best known for their Yellowtail wine label - they had to compete against companies as far away as Europe for the coveted project.

But A&G had a few advantages over the offshore companies: they had worked with Casella before, fabricating 88 x 1.1 million litre wine tanks for the company's tank farm in Yenda, NSW; they have supplied stainless steel tanks to Australia's leading breweries, wineries and beverage companies; and they are one of the largest users of stainless steel in Australia.

A&G's win is an important victory for the Australian industry as a whole and another milestone for A&G Engineering, which was founded in 1963.

The five-month Casella Brewery project, completed in August 2011, saw 25 of A&G's 200 staff use 65 tonnes of 304 grade stainless steel (including 2-4mm coil and 8mm plate) to build the 10 vessels.

A&G's Design Manager Heath Woodland said the tanks were designed to AS1210-2010 pressure vessel standards, in order to withstand a pressure rating of 115kPa.

The stainless was welded with A&G's semi-automated welding process and the internal welds were polished to achieve a 0.6R_a surface finish, to meet beverage industry standards of a food grade finish.

A&G built the vessels at their Griffith and Irymple plants, before transporting them to Yenda. With the beer fermenters now in place, it is hoped the Casella Brewery will be operational by the end of 2011.

Images courtesy of A&G Engineering.



Beer fermenters as installed at the new Casella brewery.



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From the east to west coasts, ASSDA's seminars and conferences offer opportunities to share ideas and knowledge, discuss key issues and network with other industry professionals.



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ASSDA's consistent media generation has elevated the profile and reputation of its members. Leading industry publications, publicity and marketing activities all aim to boost interest and increase the consumption of stainless steel in Australia.



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ASSDA's education vehicles include the popular Stainless Steel Specialist Course, seminars and interactive packages. ASSDA also offers free in-house architectural and engineering seminars for specifiers.



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Taking the lead to safeguard the reputation of stainless steel, ASSDA Accreditation gives asset owners and specifiers confidence that applications using stainless steel will be performed by technically competent industry specialists.



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