
AUSTRALIAN STEEL INSTITUTE
SUSTAINABILITY
IN STEEL
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THE AUSTRALIAN STEEL INSTITUTE (ASI) IS AUSTRALIA'S PEAK STEEL INDUSTRY ASSOCIATION, PROMOTING THE USE OF AUSTRALIAN STEEL IN MANUFACTURING AND CONSTRUCTION.

THE ASI SUSTAINABILITY Committee meets regularly to support the industry's sustainable initiatives, from the production process through to the application of steel solutions. The objective of the Committee is to be the focal point for the assembly of Australian steel industry data and information and to become the recognised source for this to be accessed by the construction and other industries, government and the public at large. Furthermore, the Committee leads the industry's interaction with sustainability rating bodies and authorities to ensure the proper consideration of Australian steel's environmental attributes in the various models. This is in addition to monitoring sustainability developments generally and to communicate matters of relevance promptly to members.

Over recent years, the industry has sought to respond to the marketplace need for more information on what the steel industry's sustainable product credentials are and the future path for improvement.

THE SUSTAINABILITY IN STEEL VALUE CHAIN was coined through consultation with the Institute's key stakeholders, lead by the ASI Sustainability Committee. This document is a portfolio of case studies that showcase samples of sustainable solutions in production, transformation, design and use of steel, from across Australia and New Zealand. Moreover, the underlying purpose of this document is to convey the emerging environmental consciousness of the Australian steel industry and how steel can be used as a standalone product, element, building or project that produces a sustainable solution.

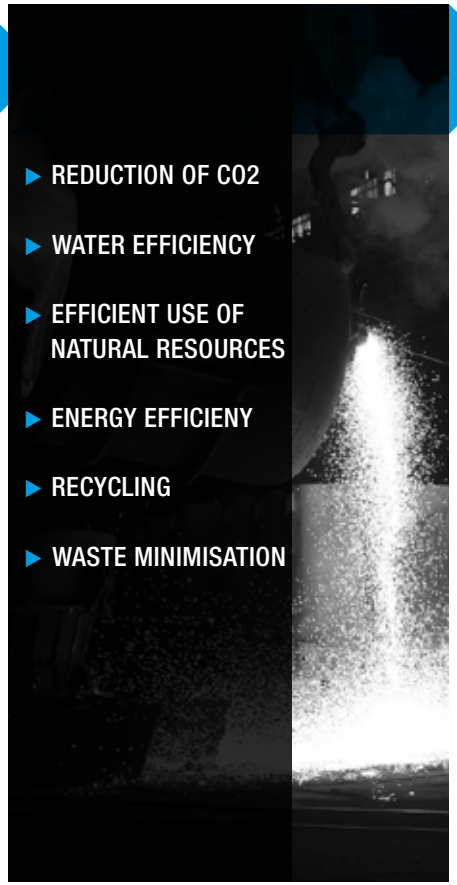
The ASI has identified four key areas in the Sustainability Value Chain and a number of key terms, which can be defined as:

The Sustainability Value Chain & Key Terms –

1. PRODUCTION: Elements of the manufacturing process that see the development of raw materials into steel by incorporating sustainable practice.
2. TRANSFORMATION: The fabrication and/or distribution of steel and steel products that aligns with environmental awareness and best practice responsibility.
3. DESIGN: Specifiers utilising the functional properties of steel to deliver sustainable outcomes.
4. USE: The applications of steel within projects that help create a more sustainable solution.

HOME

PRODUCTION



- REDUCTION OF CO2
- WATER EFFICIENCY
- EFFICIENT USE OF NATURAL RESOURCES
- ENERGY EFFICIENY
- RECYCLING
- WASTE MINIMISATION

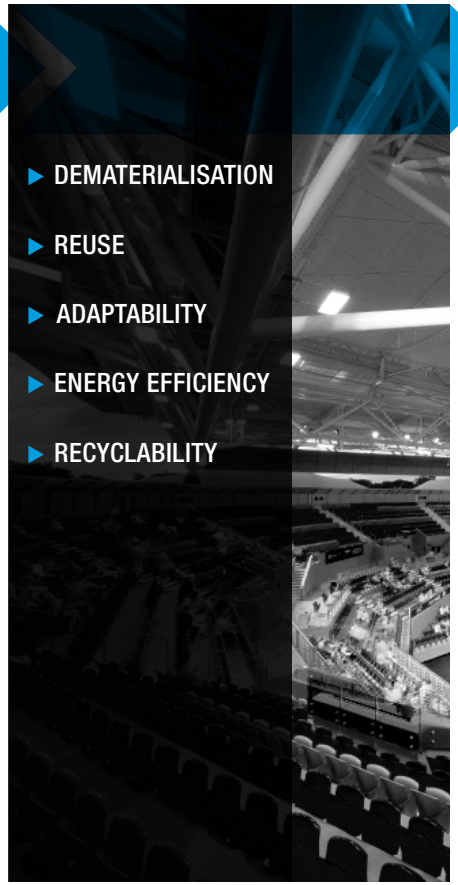
TRANSFORMATION

- WATER EFFICIENCY
- EFFICIENT USE OF NATURAL RESOURCES
- ENERGY EFFICIENCY
- WASTE MINIMISATION
- PREFABRICATION

DESIGN

- DEMATERIALISATION
- DEMOUNTABILITY
- ADAPTABILITY
- REUSE
- DESIGN FOR LONGER LIFE

USE



- DEMATERIALISATION
- REUSE
- ADAPTABILITY
- ENERGY EFFICIENCY
- RECYCLABILITY

PRODUCTION - CONTENTS

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"The technology has the potential to boost steel making productivity, cut power consumption, reduce greenhouse gas emissions and reduce landfill dumps by diverting rubber away from this stream,"
Veena Sahajwalla, Professor – University of New South Wales

PRODUCTION

ONESTEEL - POLYMER INJECTION TECHNOLOGY

SUSTAINABLE STEEL AWARD WINNER 2009

THE UNIVERSITY OF NEW SOUTH WALES (UNSW) and OneSteel have developed Polymer Injection Technology which is an exciting new patented process that partially substitutes the use of coke with polymers including rubber, as an alternate carbon injectant to produce foaming slag in Electric Arc Furnace (EAF) steel making. Between 50 and 60 percent of OneSteel's annual production of steel is via this scrap based steelmaking process.

Inventor of the technology, Professor Veena Sahajwalla of the University of New South Wales (UNSW), Australia, first developed the idea that polymers, including rubber, contain an essential source of carbon required for slag foaming in EAF steelmaking. This idea resulted in a three-year technology development and testing program conducted in partnership with OneSteel at its Sydney-based EAF facility. This innovation offers an excellent opportunity to improve steelmaking cost efficiency while also having a positive impact on the environment through energy savings and recycling polymers.

INDUSTRY TRIALS indicate that the technology for EAF steelmaking has the potential to:

- Speed the slag-foaming process;
- Reduce electricity consumption, meaning a fall in greenhouse gas emissions produced by coal-fired power stations;
- Lower the total cost of production by reducing the quantity of injectant material required;
- Improve furnace productivity by reducing 'tap-to-tap' time - a measure of the time taken to produce one batch of molten steel.

UNSW and Onesteel's Polymer Injection Technology showcases a number of ongoing environmental improvements in particular energy reductions and recycling.

ENERGY REDUCTIONS

Polymer Injection Technology has Reduced specific electrical energy consumption of approximately three percent at OneSteel's Sydney Steel Mill during recent industrial trials and reduced carbon injectant by approximately 12 percent.

RECYCLING

UNSW and OneSteel have demonstrated that polymer (rubber) is a viable carbon source for use as a slag foaming injectant. A valuable source of these polymers is tyres, which at the end of their life tend to be diverted to landfill.

Polymer Injection Technology not only reduces the requirement for virgin resource (coal) it utilises a product which is cost effective to procure and is ultimately environmentally unfriendly to dispose of.

All information contained in this case study was gleaned from the OneSteel Limited Annual Report 2009.

PRODUCTION

BLUESCOPE STEEL - WESTERN PORT

BLUESCOPE STEEL'S Western Port site is committed to ensuring a sustainable future by continually looking at ways to reduce all waste streams leading to incremental step change in performance where possible. At the site over eight years, prescribed industrial waste going to landfill has been reduced by over two thirds. It expects to reduce this further with a new solution.

An onsite project team discovered that iron-bearing filtercake, produced by wastewater treatment, is high in iron and low in contaminants and offered a number of opportunities for reuse. The most promising use is to blend the filtercake with mill scale. Today, this blended waste product is exported overseas for use in steel manufacturing, saving landfill costs and space and providing a commercial benefit.

By-products and wastes are recycled for a variety of uses including road surfaces, fertilizer and chemicals for plastics manufacturing.

WASTE MINIMISATION

The site has made a remarkable reduction in the volume of Prescribed Industrial Waste (PIW) going to landfill, more than halving the amount produced over the past seven years. This achievement resulted in a PIW reduction of 2.6 kilos per tonne of steel produced from 1999 to 2006 which equates to 65% less going to landfill.

Several key factors and new practices contributed to the waste reduction. Significant benefits were gained by changing the management of the filtercake through incorporating a drying plant and developing a stronger partnership with the waste service provider. Implementing glove and rag recycling programs, establishing a site environmental committee and applying the ISO 14001 environmental management system were also fundamental in reducing the volume.

The site has held an accredited Environmental Protection Agency (EPA) licence since 1996.

All information contained in this case study has been sourced from:
www.bluescopesteel.com.au

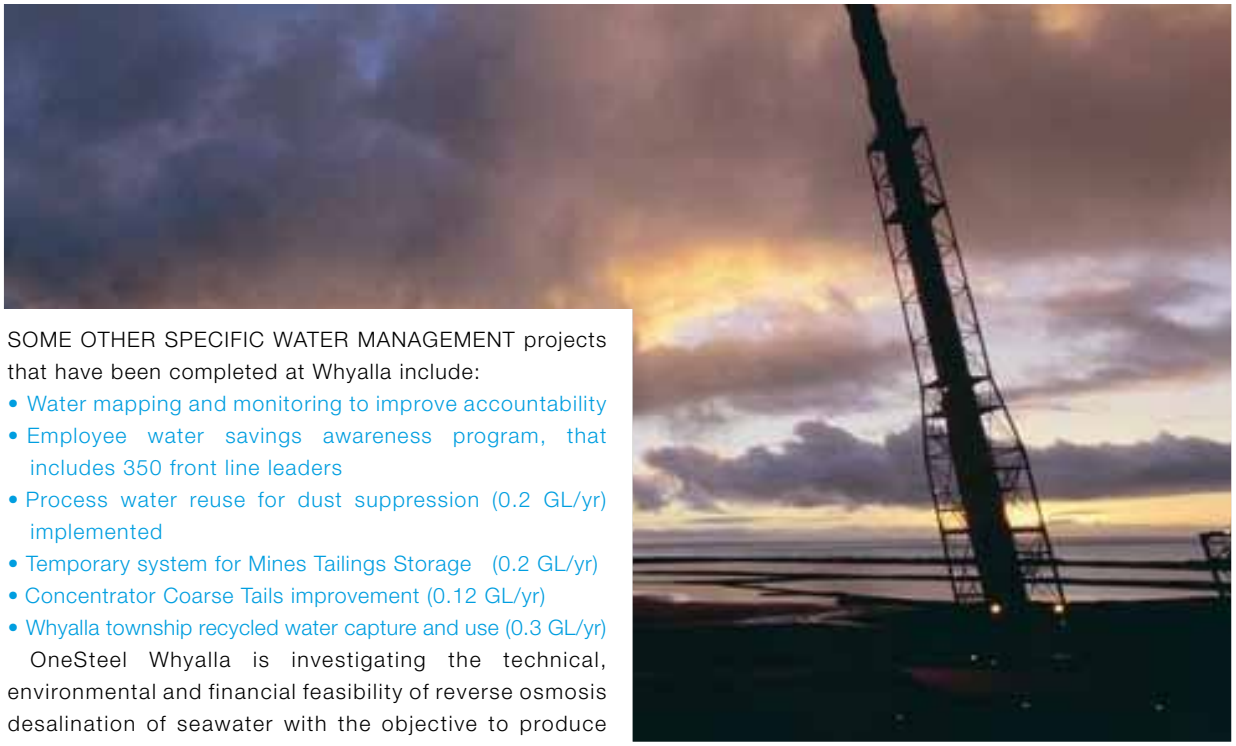
ONESTEEL - WHYALLA WATER MINIMISATION

IN 2009, introduced a multi layered strategy of measurement, awareness and savings to reduce water usage. In this recent project the Whyalla business has eased its impact on the River Murray by 800,000 litres per day, the equivalent of 16 backyard swimming pools.

WATER EFFICIENCY AT WHYALLA

OneSteel Whyalla has introduced a freshwater usage target for the combined Whyalla steelwork's and mine sites of less than 5,800 million litres per annum by December 2010. The freshwater usage for the financial year 2009 was approximately 6,200 million litres, down from 6,800 million litres in the 2008 financial year.

The steelworks takes water from a SA Water wastewater treatment plant for use in dust suppression on OneSteel's roads and stockpiles. Upgraded pipes and pumping systems have enabled the Whyalla business to deliver the recycled water to its own storage dam. In addition 155,000 litres of saltwater per annum is used for various cooling purposes, as opposed to freshwater.



SOME OTHER SPECIFIC WATER MANAGEMENT projects that have been completed at Whyalla include:

- Water mapping and monitoring to improve accountability
- Employee water savings awareness program, that includes 350 front line leaders
- Process water reuse for dust suppression (0.2 GL/yr) implemented
- Temporary system for Mines Tailings Storage (0.2 GL/yr)
- Concentrator Coarse Tails improvement (0.12 GL/yr)
- Whyalla township recycled water capture and use (0.3 GL/yr)

OneSteel Whyalla is investigating the technical, environmental and financial feasibility of reverse osmosis desalination of seawater with the objective to produce up to 1,500 million litres per annum of freshwater.

All information contained in this case study was gleaned from the OneSteel Limited Annual Report 2009.

PACIFIC STEEL GROUP - BY-PRODUCT MANAGEMENT STRATEGY

PACIFIC STEEL GROUP has played an important role in environmental sustainability by converting waste material into valuable product. By endeavouring to take a leading command of recycling, waste, water and emissions management, Pacific Steel ensures they remain true to their environmental commitments with an environmental practices office and qualified personnel to manage their burgeoning sustainability portfolio.

RECYCLING & WASTE MINIMISATION

As New Zealand's largest recycler of scrap metal, Pacific Steel converts steel into reinforcing bar, wire rods and coil products. A joint venture with sister company, Sims Pacific Metals, has allowed both parties to embark upon a series of product-management strategies namely around the notorious 200 tonne waste stockpile known as 'Mount Pacific'. Over the nine-month period it took to sort the pile, $3 million of metal was recycled back into the furnace demonstrating an effective combination of recycling and waste minimisation.

Other waste minimisation activities include a crushing and sorting plant to process all slag into product for road service application by Winstone Aggregates (GRIPCHIP™). The Electric Arc Furnace (EAF) slag is processed using a bespoke crushing and screening plant onsite at Pacific Steel. This source material is then processed through a series of computer-controlled crushers and screens where it is sized, shaped and washed to ensure consistent product. There are various other procedures to ensure all waste streams and potentially valuable by-products are monitored.

WATER EFFICIENCY

By combining new water spray systems and sustainable use of local wetlands, Pacific Steel has been able to actively reduce their environmental footprint. Originally water spray systems were required to suppress dust from waste stockpiles and additional water was required for the crusher and the wetting of dusty, unsealed roads onsite. However, as a sustainable alternative to using potable water, the pumping system draws from the wetlands during heavy rain and overflows. This ensures the protection of the facility's natural environment and minimal use of potable water.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by Pacific Steel Group, for the inaugural 2009 ASI Sustainable Steel Awards

"Whilst there will never be zero dust, I am very satisfied and impressed in respect to the way Jim White and his team are so enthusiastically addressing all areas where dust could emanate,"
Ted Kittel, Chair of the Whyalla Red Dust Action Group (WRDAG)

ONESTEEL - DUST SCREENING

ONESTEEL IS CONTINUING its push to reduce fugitive dust impacts on the community by commencing the second stage of its screening plant removal at its pelletising plant. The project is part of an extensive program that will see all redundant equipment cleaned down and removed. The current and second stage will see the removal of the number one and two screening plants, together with the complex group of conveyors associated with this equipment.

EFFICIENT USE OF NATURAL RESOURCES & WASTE MINIMISATION

The equipment has been made redundant following the commissioning of Project Magnet, and the equipment's removal will reduce the number of structures that could harbour residual dust. According to General Manager Business Sustainability Jim White, the removal of this infrastructure is another step towards improving amenity and reducing fugitive dust levels.

"This stage will not only reduce potential fugitive dust impacts but also improve the overall look of the area," he said. "There is a large amount of redundant equipment being removed in this part of the project, so residents can expect a vastly improved skyline when looking at the Steelworks from Hummock Hill."

Chair of the Whyalla Red Dust Action Group (WRDAG) Ted Kittel, and Environment Consultation Group (ECG) chair Eddie Hughes, were on hand to witness the early stages of the physical removal, which is part of ushering in a new era of processing at OneSteel Whyalla. OneSteel has been working closely with the ECG and Mr Kittel to ensure the project meets the community's needs. "Whilst there will never be zero dust, I am very satisfied and impressed in respect to the way Jim White and his team are so enthusiastically addressing all areas where dust could emanate," Mr Kittel said. "The management team has a sincere belief in what they are doing, and it is very obvious that a new culture is flourishing at OneSteel in respect to addressing and managing environmental issues." Mr Hughes also commended OneSteel on its continuing dust reduction efforts. "The latest demolition project is another tangible sign of the progress being made at OneSteel to reduce the impact of dust on the Whyalla community," he said.

The first stage of this process was completed in May 2009 was hailed a resounding success. The project went according to plan and resulted in minimal dust generation and no safety incidents thanks to careful preparation and execution. The same high standards are being applied to this stage to ensure ongoing safety and environmental excellence.

Similar to stage one, stage two will see all scrap metals recycled through OneSteel's steelmaking process or via its recycling business, while redundant equipment will also be sold to recover as much value as possible. This current stage is expected to take several months to complete.

Media Release: Dust Source Removal Stage Two Begins – 25 January 2010

PRODUCTION

BLUESCOPE STEEL - PORT KEMBLA - WATER PROJECT

WATER EFFICIENCY

At BlueScope Steel's largest global production facility, Port Kembla Steelworks in New South Wales, the great majority of water used is seawater, displacing the need to use precious fresh water in the production process.

The manufacture of iron and steel involves intense heat in many parts of the process. Water is critical to quench or cool products and machinery. Water is also required for maintenance activities and for environmental purposes like suppressing dust within the plant.

Therefore, successful water savings initiatives have been undertaken over a number of years to reduce water consumption. A key performance indicator used is fresh water intensity. This indicator outlines the amount of fresh water from community supplies used per tonne of steel manufactured. There has been significant reduction in intensity from 3.7 kilolitres per tonne in financial year (FY) 2003, to 2.1 kilolitres per tonne in FY2008, was achieved. In addition to this, a project to use recycled water from the Illawarra Sewerage Treatment works was commenced in 2006. The site has used over 16 billion litres of recycled water to date.

WASTE MINIMISATION

At the Port Kembla site, innovation in reducing, re-using and recycling materials prevents thousands of tonnes of waste going to landfill or being incinerated.

The manufacture of iron and steel generates a number of waste materials including slag, dust, grease and oil. By-products and wastes are recycled in a range of innovative ways. For example, slag is used in road surfaces and cement. Gas from coke ovens, when cleaned, produces by-products of ammonium sulphate, used as a fertilizer and chemicals used in manufacturing plastics.

Material efficiency is a measure of how efficiently a company uses raw materials to produce its products and by-products, in order to minimise waste. In the last five years, Port Kembla Steelworks material efficiency has been above 96.5%.

BlueScope Steel is actively involved in a number of industry associations, which are working towards effective by-product management solutions. In particular, the Company is a leading participant in the World Steel Association By-Products Project, an international co-operative initiative with a goal of facilitating an increase in the material efficiency of the steel industry worldwide.

All information contained in this case study has been sourced from:
www.bluescopesteel.com.au

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"While galvanising is never going to be a sustainable process, it does prolong the life of steel as a valuable resource. I particularly liked this submission for the large number of small initiatives adding up to significant environmental benefit and saving money."
Nigel Howard, Edge Environment.

TRANSFORMATION

GB GALVANISING - NEW GALVANISING PLANT

SUSTAINABLE STEEL AWARD WINNER 2009

OVER THE PAST TWO YEARS, GB Galvanizing has embarked on the design and construction of a sustainable and environmentally friendly galvanising plant by undertaking various processes improvements dealing with the issues of natural resource management and energy efficiency in an effort to reduce their environmental footprint.

By closely examining each of the processes in the galvanising process, areas of improvement were identified and solutions sought both internally and externally. GB Galvanising is now able to realise these incremental gains and is setting a standard for sustainable work practices within the steel value chain. As a result the organisation was the co-winner of the 2009 Australian Steel Institute's Sustainable Steel Awards.

EFFICIENT USE OF NATURAL RESOURCES

The upgraded GB Galvanizing plant in Victoria emphasises the capture and recycling of water to reduce potable water consumption. The facility is designed to capture 100 percent of rainwater with suspended downpipes and an expandable capacity upwards of 150,000 lt.

Conventional hot-dip galvanising requires the use of significant amounts of water and energy, particularly in the caustic cleaning process. The new caustic degreaser and flux used by GB Galvanizing reduces the rate of evaporation.

ENERGY EFFICIENCY

Energy efficiency has also been optimised through the innovative development of ways to reduce evaporation through use their unique caustic degreaser and flux. The degreaser uses a solvent-based additive and is heated at 37°C in contrast to the industry average of 90°C. This saving equates to between 4000 and 5000lt of water per day through reduced evaporation and approximately $8000 per month in the cost of natural gas. Additionally, a new nickel based flux heated at a lower temperature delivers savings of up to $5000 in gas per month and up to 3000lt of water per day.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by GB Galvanizing, for the inaugural 2009 ASI Sustainable Steel Awards

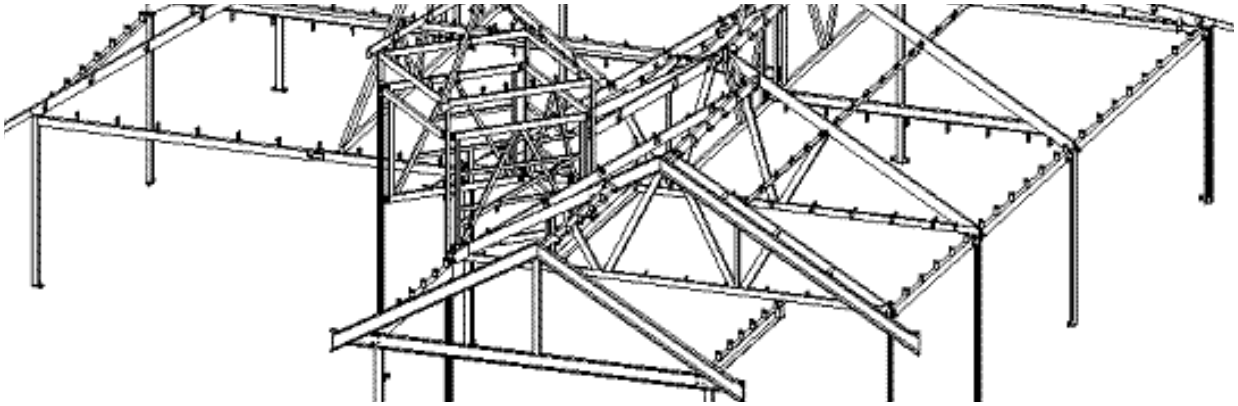
TRANSFORMATION

APPRO DRAFTING - PREFABRICATED DOMESTIC ROOF

APPRO DRAFTING identified an opportunity in the residential roofing industry to design and build a domestic steel-framed roof and ceiling structure that was completely recyclable, demountable, adaptable and durable. The resulting design, a fabricated roof and ceiling frame for domestic application, was based on an 'L' shaped plan with no internal columns, allowing flexibility in the internal layout in the house. The purpose of the design was to eliminate the use of timber frames and consequently uphold an industry-wide movement towards light gauge 'studwork' steel roof framing and consequently improve waste management.

WASTE MINIMISATION

The frame was a collaboration between Appro who drafted the roof frame and a local Perth fabricator who undertook the fabrication and final erection of the structure. The primary benefit of this relationship was that it incurred no waste material as only the completed and specifically required items were delivered to the site. All non-usable off-cuts created at the fabricator were recycled through a scrap metal recycler, ensuring the product development and final result minimised wastage through a fully integrated sustainable process.



All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by Appro Drafting, for the inaugural 2009 ASI Sustainable Steel Awards

DEMOUNTABILITY

Demountability is a key feature of the building system, which is achieved by creating an independent roof structure that doesn't require support from walls or studwork. Using bolts instead of welding the structure allows it to be easily dismantled and reassembled whilst maintaining its robust nature.

REUSE & DESIGN FOR LONGER LIFE

For this project, steel proved to be highly versatile through its favourable strength-to-weight ratio, ready availability and a durable lifespan. Rectangular Hollow Sections, Square Hollow Sections (RHS and SHS respectively) and cold-formed 'C' sections, allowed the building to be constructed with materials that fit neatly into wall cavities.

Unlike the nature of timber roof frames, steel will not sag or warp with time, which Appro considered in the design of this building. This involved not only the use of steel roofing but also galvanising this steel with a coating to 'C' sections, bolts, exposed steel and adding a red oxide coating to internal steel.

TRANSFORMATION

ARUP - 77 KING STREET, SYDNEY

SUSTAINABLE STEEL AWARD WINNER 2009

ARUP, building design and construction group, are at the forefront of an emerging trend for built environments to transition towards a sustainable future; by completing the refurbishment and extension of 77 King St in Sydney's CBD. The project showcases the reuse and adaptation of an existing structure as an alternative to demolishing, which upholds the 'reduce, reuse, recycle' hierarchy to deliver one of Sydney's most impressive and sustainable buildings.

PREFABRICATION, REUSE AND ENERGY EFFICIENCY

The existing 19-storey structure was extended vertically by four levels and extensively renovated using steel to create additional floor space. Steel played a pivotal role in designing the refurbishment due to its high strength-to-weight properties that facilitated the vertical extension. The remodel of the old Westpac office, computer centre, car park and plant room was achieved using steel custom designed brackets in the floor plates to add 2500m² more leasable space and a unique façade. Furthermore, the flexibility and adaptability of steel used has not only accommodated for operational efficiency but also environmental sustainability.

ADAPTABILITY & DESIGN FOR LONGER LIFE

In addition to the reinvention of existing space, façade development and efficiency are key sustainability attributes which Arup have integrated into the design of the building. By extending the George St entrance of the building, a three-storey glass box to the boundary of the property now houses Australia's flagship Apple Store and utilises natural light as a feature. Subsequently this reduces power usage for utilities such as lighting and heating throughout the building.

During the building application process, the principal entered a Commitment Agreement to achieve a high energy rating with the NSW Department of Energy, Utilities and Sustainability (DEUS). Under this agreement, a mechanical and electrical solution known as 'chilled beam' technology was used for the centre zone combined with active beams for the perimeter of the floor plate where the heat loads are greater. This reduced the need for supply air risers and

eliminated most beam penetrations in the new floor system as the chilled beam coolant pipes are fitted under secondary beams.

DEMATERIALISATION

Through minimisation of waste and materials, the building refurbishment is an embodiment of 'reduce, reuse, recycle' sustainability methods. This was achieved through reducing the amount of waste sent to landfill, avoiding the need for materials required to construct a new building of the same quality and the reuse of core elements of the structure.

The building was a winner in the Australian Steel Institute's Sustainable Steel Awards 2009 in 'Developing Sustainable Products and Solutions' category.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by Arup, for the inaugural 2009 ASI Sustainable Steel Awards

TRANSFORMATION

ILB BUILDINGS - INDUSTRIAL LIGHT BEAM

THE INDUSTRIAL LIGHT BEAM (ILB) is used by various industries, from commercial and mining through to agricultural and residential, in suitable applications for fabricated sections. ILB are made from rolled and square hollow sections (RHS and SHS respectively), chord members and a continuously welded folded plate web, to deliver a lightweight, environmentally sustainable product.

DEMATERIALISATION& DEMOUNTABILITY

The ILB design system provides a number of environmental benefits through a material minimisation process employed when manufacturing ILB products. All ILB sections are designed with minimal wastage; for example by using only available cord widths to ensure near zero wastage is incurred through the slitting process. Furthermore, each project is fabricated as per exact workshop drawings and produced at exact lengths, which not only avoids wastage but also excessive energy use.

As a by-product of the revolutionary design, there are core savings on steel mass of around 45 percent achieved over conventional designs. In relative terms, this reduces over 2000t of carbon dioxide produced by ILB annually, without the consideration of emissions spared through reduced transport needs. Additionally, this reduces water usage by 245,000kl per year.

WASTE MINIMISATION

In an effort to become more sustainable, the staff and management at ILB are dedicated to continually improving the processing and design of ILB products. Their goal is to minimise the carbon footprint of construction projects by reducing tonnes fabricated and ensuring designs are lightweight, have high flexural and great torsional stiffness. Also, the potential for distortion of the product is minimised due to the inherent stability of RHS sections, whilst curving of the ILB is facilitated more easily without power-intensive heating processes.

Without compromising the architectural quality of the design, ILB have developed a smart product that reduces on-site handling. This is an added bonus that simultaneously works in favour of safety and adds value to the sustainability portfolio of ILB, by lessening the use of heavy machinery for lifting (i.e. cranes).

REUSABLE & ADAPTABLE

Mines and other resource clients are discovering the versatility of ILB products through its lightweight that allows repetitive assembly and disassembly of the product in different locations. The strength of the ILB system includes use in aircraft hangars, freight terminals and other facilities that require large clear spans.

Additionally, extensive testing has been carried out on the ILB system by the Sydney University, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Lynar Consulting Engineers; the cumulative results of these independent tests all confirm the strength, lightweight and durability properties of the ILB system.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by ILB, for the inaugural 2009 ASI Sustainable Steel Awards.

TRANSFORMATION

VDM CONSULTING - BELL RESIDENCE

SUSTAINABLE STEEL AWARD WINNER 2009

VDM CONSULTING STRUCTURAL ENGINEERS in conjunction with architect Andrew Bell have created a family residence that strikes a natural affinity between affordability, efficiency and environmental sustainability. The unique prefabrication method and demountability of the home was developed around a fully integrated design - infusing energy and water reduction with waste minimisation, recyclability and adaptability. The building was given the Judges' Award in the Australian Steel Institute's Sustainable Steel Awards 2009 due to its commendable development of sustainable products and solutions.

PREFABRICATION, DEMATERIALISATION & DEMOUNTABILITY

One of the main features of this 6-Star Green Star rated building is prefabrication, which has several environmental sustainability benefits, including: waste minimisation and water and energy reduction.

Firstly, prefabrication of the structural steel, wall, roof panels and floor joists allowed waste minimisation by providing a framework for a straightforward process between internal and external trades (i.e. the wall and roof panels join using standard clips). This in turn allowed the building's roof, wall and structural components to be developed with zero wastage.

Additionally, the demountability of the home through the use of prefabricated wall and roof panels is a unique feature that highlights the focus on sustainable design principles. Due to the componentisation of the design, the building can be demounted, flat packed and moved to another site. Some of the product components include: precast insulated concrete wall panels, timber framed windows and COLORBOND® roof panels, all of which are easily moved and reassembled.

RECYCLABILITY & DESIGN FOR LONGER LIFE

Not only is the home demountable but the building's design allows it to be easily recycled piece-by-piece and constructed with other sustainable applications in mind. For example, the timber off-cuts from construction were stored onsite for burning in the slow combustion fireplace and the solar screens are made from plantation hardwood.

Additionally, the house has many design features that culminate to enhance the building's environmental adaptability. These include: supporting the National Accessibility Initiatives by accommodating for an ageing occupant with wider doorways, ramps and accessible amenities, a bungalow for younger family members, allowance for additional floor space above the living room and also flexibility for the building to be extended and interiors converted into dual units for leasing on the site.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by VDM Consulting Structural Engineers, for the inaugural 2009 ASI Sustainable Steel Awards

TRANSFORMATION

20*20 - 20*20 BUILDING SYSTEM

HOMES DEVELOPED BY 20*20 have been labelled 'the solution to the West Australian Housing Crisis' according to Channel 7's Revolution Road amongst other accolades, which includes winning the HIA Western Australia Greensmart Product of the Year, for their ability to deliver affordable and ecologically friendly homes. Most relevant to the way in which 20*20 turns sustainability into reality is through the '2020 Easy Build System' which was specifically developed for regional Australian communities.

The sustainable application of the 2020 System draws on a number of considerations including waste minimisation, energy efficiency and recyclability that are suitable for regional Australian homes.

WASTE MINIMISATION

By manufacturing the steel based construction elements off-site, the system is more efficient, cleaner and safer than traditional on-site assembly whilst simultaneously decreasing construction time, increasing predictability of the project completion and decreasing defects. The main feature of this process that highlights sustainability, is incurring less waste. Any waste that is acquired is easily recycled, although the need for this is minimal as components are delivered to the site at the correct dimensions and thus reducing negligible waste. The 20*20 system uses a cold formed 'C' panel that is cut into the desired length to create wall panels which is designed with little or no waste.

*All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by 20*20, for the inaugural 2009 ASI Sustainable Steel Awards*

ENERGY EFFICIENCY & RECYCLABILITY

All 20*20 homes are fashioned to optimise energy efficiency with an energy rating of between 7.5 and 8.5. This is facilitated via utilisation of venting systems, energy efficient air conditioning, sun shading, insulation and environmentally conscious lighting. Energy efficiency is also brought to fruition with the alignment of human and natural environments with landscape architecture tempering the environmental conditions of the site.

A key design feature of the 20*20 System is the recognition of the importance of recyclability. Each home is built with materials that equates to an overall 80% recyclability and all homes can be dismantled and reused for other applications and subsequently adding to the product's life cycle.

Additionally, in order to uphold Environmental Sustainable Design values, 20*20 Structures include a means of easily measuring energy consumption and efficiency, a recycling management system for each home and communicates sustainability objectives that include reference to energy standards and certification where possible.

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DESIGN

BARK DESIGN ARCHITECTS - VISITOR INFORMATION CENTRE, NOOSA

BARK DESIGN ARCHITECTS in collaboration with Sunshine Coast Regional Council, created the Visitor Information Centre (VIC) along Noosa's Hastings Street. During initial consultations, it was established that the VIC needed to showcase natural light and inspiration was taken from a leaf, to produce a 'stand alone' building that attracts over 200 000 locals and tourists annually. The VIC's innovative design encapsulates earthy elements with an emphasis on demountability, reuse, sustainable material selection and durability.

DEMOUNTABILITY

The structural concept for the project was to make use of prefabrication to allow for a canopy roof to be installed in a short amount of time. The steel frame was assembled in three days on site, and will tolerate easy dismantling and eventual recyclability due to its light weight and favourable bolting mechanism.

DEMATERIALISATION

Material selection was consistent with two key criteria. Firstly, all materials used were Australian made and sourced locally to not only support the local economy but also to reduce environmental transport costs and fuel consumption to improve the building's carbon footprint. Secondly, all products selected are recyclable or are a bi-product of recycling (i.e. 100% of the steel structure and recycled local hardwood). For functionality and aesthetic appeal the recyclable steel structure and glass provide open free flowing transparency, is contrasted with the natural warmth of a sustainable material palette of recycled Australian hardwood joinery sourced from a demolished woolshed, plantation grown plywood and Queensland 'Spotted Gum' hardwood timberwork.

DESIGN FOR LONGER LIFE

An innate challenge in the design process was catering to the Visitor Information Centre's harsh coastal conditions that can have a tendency to affect the durability of steel. To overcome this, all exposed and accessible members were hot dipped galvanized for corrosion protection. This process also brings to light 'silver' characteristics of the material and thus adding to the building's visual appeal.

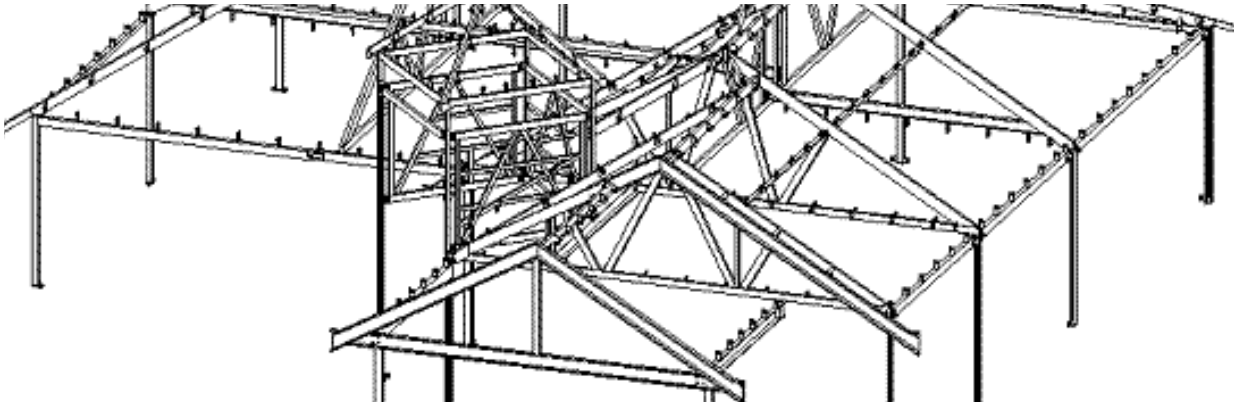
These points of sustainability culminate to confirm the Noosa Visitor Information Centre as a tangible representation of sustainable interactions between nature and human environmentally responsible action in the design and construction industry.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by Bark Design, for the inaugural 2009 ASI Sustainable Steel Awards

DESIGN

APPRO DRAFTING - PREFABRICATED DOMESTIC ROOF

APPRO DRAFTING identified an opportunity in the residential roofing industry to design and build a domestic steel-framed roof and ceiling structure that was completely recyclable, demountable, adaptable and durable. The resulting design, a fabricated roof and ceiling frame for domestic application, was based on an 'L' shaped plan with no internal columns, allowing flexibility in the internal layout in the house. The purpose of the design was to eliminate the use of timber frames and consequently uphold an industry-wide movement towards light gauge 'studwork' steel roof framing and consequently improve waste management.



All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by Appro Drafting, for the inaugural 2009 ASI Sustainable Steel Awards.

WASTE MINIMISATION

The frame was a collaboration between Appro who drafted the roof frame and a local Perth fabricator who undertook the fabrication and final erection of the structure. The primary benefit of this relationship was that it incurred no waste material as only the completed and specifically required items were delivered to the site. All non-usable off-cuts created at the fabricator were recycled through a scrap metal recycler, ensuring the product development and final result minimised wastage through a fully integrated sustainable process.

DEMOUNTABILITY

Demountability is a key feature of the building system, which is achieved by creating an independent roof structure that doesn't require support from walls or studwork. Using bolts instead of welding the structure allows it to be easily dismantled and reassembled whilst maintaining its robust nature.

REUSE & DESIGN FOR LONGER LIFE

For this project, steel proved to be highly versatile through its favourable strength-to-weight ratio, ready availability and a durable lifespan. Rectangular Hollow Sections, Square Hollow Sections (RHS and SHS respectively) and cold-formed 'C' sections, allowed the building to be constructed with materials that fit neatly into wall cavities.

Unlike the nature of timber roof frames, steel will not sag or warp with time, which Appro considered in the design of this building. This involved not only the use of steel roofing but also galvanising this steel with a coating to 'C' sections, bolts, exposed steel and adding a red oxide coating to internal steel.

DESIGN

ARUP - 77 KING STREET, SYDNEY

SUSTAINABLE STEEL AWARD WINNER 2009

ARUP, building design and construction group, are at the forefront of an emerging trend for built environments to transition towards a sustainable future; by completing the refurbishment and extension of 77 King St in Sydney's CBD. The project showcases the reuse and adaptation of an existing structure as an alternative to demolishing, which upholds the 'reduce, reuse, recycle' hierarchy to deliver one of Sydney's most impressive and sustainable buildings.

PREFABRICATION, REUSE AND ENERGY EFFICIENCY

The existing 19-storey structure was extended vertically by four levels and extensively renovated using steel to create additional floor space. Steel played a pivotal role in designing the refurbishment due to its high strength-to-weight properties that facilitated the vertical extension. The remodel of the old Westpac office, computer centre, car park and plant room was achieved using steel custom designed brackets in the floor plates to add 2500m² more leasable space and a unique façade. Furthermore, the flexibility and adaptability of steel used has not only accommodated for operational efficiency but also environmental sustainability.

ADAPTABILITY & DESIGN FOR LONGER LIFE

In addition to the reinvention of existing space, façade development and efficiency are key sustainability attributes which Arup have integrated into the design of the building. By extending the George St entrance of the building, a three-storey glass box to the boundary of the property now houses Australia's flagship Apple Store and utilises natural light as a feature. Subsequently this reduces power usage for utilities such as lighting and heating throughout the building.

During the building application process, the principal entered a Commitment Agreement to achieve a high energy rating with the NSW Department of Energy, Utilities and Sustainability (DEUS). Under this agreement, a mechanical and electrical solution known as 'chilled beam' technology was used for the centre zone combined with active beams for the perimeter of the floor plate where the heat loads are greater. This reduced the need for supply air risers and eliminated most beam penetrations in the new floor system as the chilled beam coolant pipes are fitted under secondary beams.

DEMATERIALISATION

Through minimisation of waste and materials, the building refurbishment is an embodiment of 'reduce, reuse, recycle' sustainability methods. This was achieved through reducing the amount of waste sent to landfill, avoiding the need for materials required to construct a new building of the same quality and the reuse of core elements of the structure.

The building was a winner in the Australian Steel Institute's Sustainable Steel Awards 2009 in 'Developing Sustainable Products and Solutions' category.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by Arup, for inaugural 2009 ASI Sustainable Steel Awards

DESIGN

ILB BUILDINGS - INDUSTRIAL LIGHT BEAM

THE INDUSTRIAL LIGHT BEAM (ILB) is used by various industries, from commercial and mining through to agricultural and residential, in suitable applications for fabricated sections. ILB are made from rolled and square hollow sections (RHS and SHS respectively), chord members and a continuously welded folded plate web, to deliver a lightweight, environmentally sustainable product.

DEMATERIALISATION& DEMOUNTABILITY

The ILB design system provides a number of environmental benefits through a material minimisation process employed when manufacturing ILB products. All ILB sections are designed with minimal wastage; for example by using only available cord widths to ensure near zero wastage is incurred through the slitting process. Furthermore, each project is fabricated as per exact workshop drawings and produced at exact lengths, which not only avoids wastage but also excessive energy use.

As a by-product of the revolutionary design, there are core savings on steel mass of around 45 percent achieved over conventional designs. In relative terms, this reduces over 2000t of carbon dioxide produced by ILB annually, without the consideration of emissions spared through reduced transport needs. Additionally, this reduces water usage by 245,000kl per year.

WASTE MINIMISATION

In an effort to become more sustainable, the staff and management at ILB are dedicated to continually improving the processing and design of ILB products. Their goal is to minimise the carbon footprint of construction projects by reducing tonnes fabricated and ensuring designs are lightweight, have high flexural and great torsional stiffness. Also, the potential for distortion of the product is minimised due to the inherent stability of RHS sections, whilst curving of the ILB is facilitated more easily without power-intensive heating processes.

Without compromising the architectural quality of the design, ILB have developed a smart product that reduces on-site handling. This is an added bonus that simultaneously works in favour of safety and adds value to the sustainability portfolio of ILB, by lessening the use of heavy machinery for lifting (i.e. cranes).

REUSABLE & ADAPTABLE

Mines and other resource clients are discovering the versatility of ILB products through its lightweight that allows repetitive assembly and disassembly of the product in different locations. The strength of the ILB system includes use in aircraft hangars, freight terminals and other facilities that require large clear spans.

Additionally, extensive testing has been carried out on the ILB system by the Sydney University, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Lynar Consulting Engineers; the cumulative results of these independent tests all confirm the strength, lightweight and durability properties of the ILB system.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by ILB, for the inaugural 2009 ASI Sustainable Steel Awards

"The project is a tremendous example of how a low rise, light weight steel building can be developed with a full steel frame design, delivering a structure that optimises is ability to prove its demountable, recyclable and easily retrofitted credentials in a low impact and sustainable way." **Ray Vallet,** Product Manager - LiteSteel Technologies

DESIGN

LITESTEEL TECHNOLOGIES - YHA BUILDING THE ROCKS, SYDNEY

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by LiteSteel Technologies, for the inaugural 2009 ASI Sustainable Steel Awards

THE NEW YOUTH HOSTEL ASSOCIATION (YHA) in Sydney's The Rocks is poised to be one of the world's premier hostel destinations with panoramic views of the Opera House and Sydney Harbour, the use of LiteSteel Beam in the project draws on a innovative design to minimise impact on this historic site. The Sydney Harbour Foreshore Authority called for innovative proposals for the design and conservation development of the area known as the 'Big Dig Site' in the historic precinct of The Rocks. The 2650m2 site has outstanding cultural significance and contains rare physical evidence of Australia's first European settlement.

A steel truss system incorporating LiteSteel Beam was utilised to raise the building off the ground on a series of pillars, minimising points of contact with the ground. The location of the footings of the four-storey structure was carefully negotiated through consultations between architectural, heritage, archaeological, structural and geotechnical consultants. This combined with prefabrication was in an effort to protect the natural environment and upholding sustainable responsibilites, including demountability, reuse and material and waste minimisation.

DEMOUNTABILITY & REUSE

One of the features of the LiteSteel system in the twin buildings is that it allows the floor of each tower to be unbolted through its design and is apt for subsequent reuse. This adaptability is advantageous for possible future refurbishments and is further improved when considering significant weight has been taken out of the structure without the use of concrete and supported by LiteSteel beams.

DEMATERIALISATION & DESIGN FOR LONGER LIFE

By using steel prefabrication during the construction, wastage and installation time were both minimised. LiteSteel beam (LSB) is an important contributor to the success of this site with its long span and light weight attributes preferred over timber as the joists throughout the 4 storey structure. By sourcing an alternative to the use of timber, wastage was further reduced by avoiding the need to dispose and remove off-cuts and concerns over dust contamination and noise pollution were eliminated.

Litesteel Beam (LSB) is manufactured with an Aluminium Zincalum (AZ+) surface coating finish which provides a high level of atmospheric corrosion protection, ensuring that lifecycle performance for the floor joists was able to be maintained in this harbourside location.

DESIGN

S² CORPORATION - AUSTRALIAN EQUINE & LIVESTOCK EVENTS CENTRE AND BOEING AIRSPACE

S² CORPORATION (S²) specialises in the design and implementation of large span facilities and uses a patented post-tensioned steel technology to service its niche market. There are two examples of projects that highlight both reducing steel's footprint on the environment and turning sustainability into reality known as the Australian Equine and Livestock Events Centre (AELEC) and Boeing Airspace Hangar respectively. Both of these projects align with modern sustainability practices as products to position the innovation demonstrated by S² as one of the industry's current best practices.

AELEC was a $28 million project in which S² designed and engineered a building with seating for up to 5000 people (60m span), an additional warm up area catering for 660 people (42m span) and six stable buildings (25m span each). S² employed a series of structural design concepts, economy considerations and demonstrated practicality in fabrication and erection to develop an environmentally smart and sustainable facility.

ADAPTABILITY

AELEC features a number of sustainability attributes, which include adaptability, energy minimisation and recyclability. By creating vast areas of column-free space replacing traditional structures and column grids, S² enhanced the venue's adaptability. Due to the large seating capacity combined with vast open space, the AELEC can easily be converted into a dynamic entertainment venue. In practice, the AELEC has already proven a success since opening in Tamworth in 2008 as the venue is full nearly all year round and supports the area's burgeoning $45 million equine and livestock event industry.

DEMATERIALISATION & ENERGY EFFICIENCY

The structure's post-tensioned steel solution facilitated the reduction of up to 40% in the overall weight of steel compared with similar designs. This saw beneficial impacts across fabrication and assembly process and because of the ability to store energy an increased span is possible. By using this technology, the structure's steel tonnage is approximately half the weight of regular projects that sees advantageous environmental benefits across manufacturing, fabrication and delivery supply chain by keeping truck movements to a minimum. Furthermore to reduce waste and carbon emissions, the entire steel elements of the structure are 100% recyclable.

Boeing airspace is another example of intuitive sustainable design and engineering by S² done with the purpose of sheltering large aircraft for Boeing in Amberley (Queensland). The resulting roof product is known as 'airspace' and stands at 14.2m tall and 67.5m across the length and width.

RECYCLABILITY

The airspace's lightweight and demountability are features that allow the structure to overcome challenges, which were to ensure the cover fit between two existing buildings and allow aircraft access from three sides, which was considered in design and practical assembly.

As seen in the AELEC, airspace's post-tensioned steel solution results in an approximate saving of up to 40% in overall steel weight, complete recyclability of the steel structure, adaptability elements and prefabrication.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by S² Corporation, for the inaugural 2009 ASI Sustainable Steel Awards

DESIGN

VDM CONSULTING - BELL RESIDENCE

SUSTAINABLE STEEL AWARD WINNER 2009

VDM CONSULTING STRUCTURAL ENGINEERS in conjunction with architect Andrew Bell have created a family residence that strikes a natural affinity between affordability, efficiency and environmental sustainability. The unique prefabrication method and demountability of the home was developed around a fully integrated design - infusing energy and water reduction with waste minimisation, recyclability and adaptability. The building was given the Judges' Award in the Australian Steel Institute's Sustainable Steel Awards 2009 due to its commendable development of sustainable products and solutions.

PREFABRICATION, DEMATERIALISATION & DEMOUNTABILITY

One of the main features of this 6-Star Green Star rated building is prefabrication, which has several environmental sustainability benefits, including: waste minimisation and water and energy reduction.

Firstly, prefabrication of the structural steel, wall, roof panels and floor joists allowed waste minimisation by providing a framework for a straightforward process between internal and external trades (i.e. the wall and roof panels join using standard clips). This in turn allowed the building's roof, wall and structural components to be developed with zero wastage.

Additionally, the demountability of the home through the use of prefabricated wall and roof panels is a unique feature that highlights the focus on sustainable design principles. Due to the componentisation of the design, the building can be demounted, flat packed and moved to another site. Some of the product components include: precast insulated concrete wall panels, timber framed windows and COLORBOND® roof panels, all of which are easily moved and reassembled.

RECYCLABILITY & DESIGN FOR LONGER LIFE

Not only is the home demountable but the building's design allows it to be easily recycled piece-by-piece and constructed with other sustainable applications in mind. For example, the timber off-cuts from construction were stored onsite for burning in the slow combustion fireplace and the solar screens are made from plantation hardwood.

Additionally, the house has many design features that culminate to enhance the building's environmental adaptability. These include: supporting the National Accessibility Initiatives by accommodating for an ageing occupant with wider doorways, ramps and accessible amenities, a bungalow for younger family members, allowance for additional floor space above the living room and also flexibility for the building to be extended and interiors converted into dual units for leasing on the site.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by VDM Consulting Structural Engineers, for the inaugural 2009 ASI Sustainable Steel Awards.

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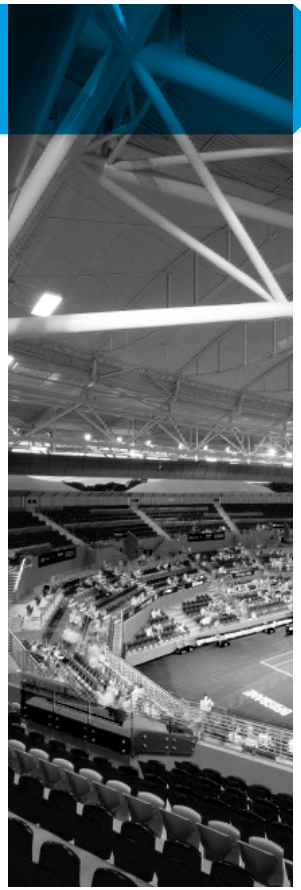

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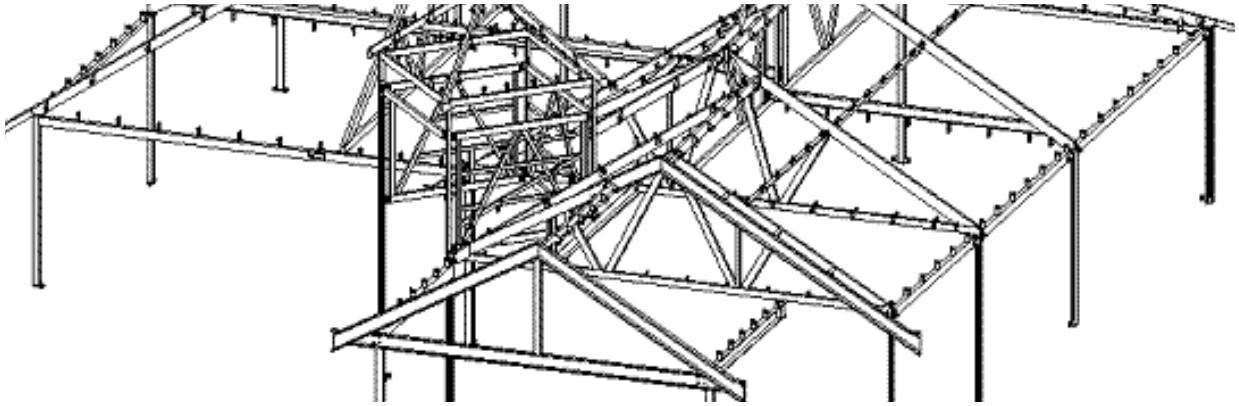
USE

▶ APPRO DRAFTING - PREFABRICATED DOMESTIC ROOF

APPRO DRAFTING identified an opportunity in the residential roofing industry to design and build a domestic steel-framed roof and ceiling structure that was completely recyclable, demountable, adaptable and durable. The resulting design, a fabricated roof and ceiling frame for domestic application, was based on an 'L' shaped plan with no internal columns, allowing flexibility in the internal layout in the house. The purpose of the design was to eliminate the use of timber frames and consequently uphold an industry-wide movement towards light gauge 'studwork' steel roof framing and consequently improve waste management.



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WASTE MINIMISATION

The frame was a collaboration between Appro who drafted the roof frame and a local Perth fabricator who undertook the fabrication and final erection of the structure. The primary benefit of this relationship was that it incurred no waste material as only the completed and specifically required items were delivered to the site. All non-usable off-cuts created at the fabricator were recycled through a scrap metal recycler, ensuring the product development and final result minimised wastage through a fully integrated sustainable process.

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Unlike the nature of timber roof frames, steel will not sag or warp with time, which Appro considered in the design of this building. This involved not only the use of steel roofing but also galvanising this steel with a coating to 'C' sections, bolts, exposed steel and adding a red oxide coating to internal steel.

BARK DESIGN ARCHITECTS - VISITOR INFORMATION CENTRE, NOOSA

BARK DESIGN ARCHITECTS in collaboration with Sunshine Coast Regional Council, created the Visitor Information Centre (VIC) along Noosa's Hastings Street. During initial consultations, it was established that the VIC needed to showcase natural light and inspiration was taken from a leaf, to produce a 'stand alone' building that attracts over 200 000 locals and tourists annually. The VIC's innovative design encapsulates earthy elements with an emphasis on demountability, reuse, sustainable material selection and durability.

DEMOUNTABILITY

The structural concept for the project was to make use of prefabrication to allow for a canopy roof to be installed in a short amount of time. The steel frame was assembled in three days on site, and will tolerate easy dismantling and eventual recyclability due to its light weight and favourable bolting mechanism.

DEMATERIALISATION

Material selection was consistent with two key criteria. Firstly, all materials used were Australian made and sourced locally to not only support the local economy but also to reduce environmental transport costs and fuel consumption to improve the building's carbon footprint. Secondly, all products selected are recyclable or are a bi-product of recycling (i.e. 100% of the steel structure and recycled local hardwood). For functionality and aesthetic appeal the recyclable steel structure and glass provide open free flowing transparency, is contrasted with the natural warmth of a sustainable material palette of recycled Australian hardwood joinery sourced from a demolished woolshed, plantation grown plywood and Queensland 'Spotted Gum' hardwood timberwork.

DESIGN FOR LONGER LIFE

An innate challenge in the design process was catering to the Visitor Information Centre's harsh coastal conditions that can have a tendency to affect the durability of steel. To overcome this, all exposed and accessible members were hot dipped galvanized for corrosion protection. This process also brings to light 'silver' characteristics of the material and thus adding to the building's visual appeal.

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USE

ARUP - 77 KING STREET, SYDNEY

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ARUP, building design and construction group, are at the forefront of an emerging trend for built environments to transition towards a sustainable future; by completing the refurbishment and extension of 77 King St in Sydney's CBD. The project showcases the reuse and adaptation of an existing structure as an alternative to demolishing, which upholds the 'reduce, reuse, recycle' hierarchy to deliver one of Sydney's most impressive and sustainable buildings.

PREFABRICATION, REUSE AND ENERGY EFFICIENCY

The existing 19-storey structure was extended vertically by four levels and extensively renovated using steel to create additional floor space. Steel played a pivotal role in designing the refurbishment due to its high strength-to-weight properties that facilitated the vertical extension. The remodel of the old Westpac office, computer centre, car park and plant room was achieved using steel custom designed brackets in the floor plates to add 2500m² more leasable space and a unique façade. Furthermore, the flexibility and adaptability of steel used has not only accommodated for operational efficiency but also environmental sustainability.

ADAPTABILITY & DESIGN FOR LONGER LIFE

In addition to the reinvention of existing space, façade development and efficiency are key sustainability attributes which Arup have integrated into the design of the building. By extending the George St entrance of the building, a three-storey glass box to the boundary of the property now houses Australia's flagship Apple Store and utilises natural light as a feature. Subsequently this reduces power usage for utilities such as lighting and heating throughout the building.

During the building application process, the principal entered a Commitment Agreement to achieve a high energy rating with the NSW Department of Energy, Utilities and Sustainability (DEUS). Under this agreement, a mechanical and electrical solution known as 'chilled beam' technology was used for the centre zone combined with active beams for the perimeter of the floor plate where the heat loads are greater. This reduced the need for supply air risers and

eliminated most beam penetrations in the new floor system as the chilled beam coolant pipes are fitted under secondary beams.

DEMATERIALISATION

Through minimisation of waste and materials, the building refurbishment is an embodiment of 'reduce, reuse, recycle' sustainability methods. This was achieved through reducing the amount of waste sent to landfill, avoiding the need for materials required to construct a new building of the same quality and the reuse of core elements of the structure.

The building was a winner in the Australian Steel Institute's Sustainable Steel Awards 2009 in 'Developing Sustainable Products and Solutions' category.

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USE

20*20 - 20*20 BUILDING SYSTEM

HOMES DEVELOPED BY 20*20 have been labelled 'the solution to the West Australian Housing Crisis' according to Channel 7's Revolution Road amongst other accolades, which includes winning the HIA Western Australia Greensmart Product of the Year, for their ability to deliver affordable and ecologically friendly homes. Most relevant to the way in which 20*20 turns sustainability into reality is through the '2020 Easy Build System' which was specifically developed for regional Australian communities.

The sustainable application of the 2020 System draws on a number of considerations including waste minimisation, energy efficiency and recyclability that are suitable for regional Australian homes.

WASTE MINIMISATION

By manufacturing the steel based construction elements off-site, the system is more efficient, cleaner and safer than traditional on-site assembly whilst simultaneously decreasing construction time, increasing predictability of the project completion and decreasing defects. The main feature of this process that highlights sustainability, is incurring less waste. Any waste that is acquired is easily recycled, although the need for this is minimal as components are delivered to the site at the correct dimensions and thus reducing negligible waste. The 20*20 system uses a cold formed 'C' panel that is cut into the desired length to create wall panels which is designed with little or no waste.

*All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by 20*20, for the inaugural 2009 ASI Sustainable Steel Awards*

ENERGY EFFICIENCY & RECYCLABILITY

All 20*20 homes are fashioned to optimise energy efficiency with an energy rating of between 7.5 and 8.5. This is facilitated via utilisation of venting systems, energy efficient air conditioning, sun shading, insulation and environmentally conscious lighting. Energy efficiency is also brought to fruition with the alignment of human and natural environments with landscape architecture tempering the environmental conditions of the site.

A key design feature of the 20*20 System is the recognition of the importance of recyclability. Each home is built with materials that equates to an overall 80% recyclability and all homes can be dismantled and reused for other applications and subsequently adding to the product's life cycle.

Additionally, in order to uphold Environmental Sustainable Design values, 20*20 Structures include a means of easily measuring energy consumption and efficiency, a recycling management system for each home and communicates sustainability objectives that include reference to energy standards and certification where possible.

USE

ILB BUILDINGS - INDUSTRIAL LIGHT BEAM

THE INDUSTRIAL LIGHT BEAM (ILB) is used by various industries, from commercial and mining through to agricultural and residential, in suitable applications for fabricated sections. ILB are made from rolled and square hollow sections (RHS and SHS respectively), chord members and a continuously welded folded plate web, to deliver a lightweight, environmentally sustainable product.

DEMATERIALISATION& DEMOUNTABILITY

The ILB design system provides a number of environmental benefits through a material minimisation process employed when manufacturing ILB products. All ILB sections are designed with minimal wastage; for example by using only available cord widths to ensure near zero wastage is incurred through the slitting process. Furthermore, each project is fabricated as per exact workshop drawings and produced at exact lengths, which not only avoids wastage but also excessive energy use.

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WASTE MINIMISATION

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Without compromising the architectural quality of the design, ILB have developed a smart product that reduces on-site handling. This is an added bonus that simultaneously works in favour of safety and adds value to the sustainability portfolio of ILB, by lessening the use of heavy machinery for lifting (i.e. cranes).

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Mines and other resource clients are discovering the versatility of ILB products through its lightweight that allows repetitive assembly and disassembly of the product in different locations. The strength of the ILB system includes use in aircraft hangars, freight terminals and other facilities that require large clear spans.

Additionally, extensive testing has been carried out on the ILB system by the Sydney University, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Lynar Consulting Engineers; the cumulative results of these independent tests all confirm the strength, lightweight and durability properties of the ILB system.

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USE

LITESTEEL TECHNOLOGIES - YHA BUILDING THE ROCKS, SYDNEY

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DEMOUNTABILITY & REUSE

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DEMATERIALISATION & DESIGN FOR LONGER LIFE

By using steel prefabrication during the construction, wastage and installation time were both minimised. LiteSteel beam (LSB) is an important contributor to the success of this site with its long span and light weight attributes preferred over timber as the joists throughout the 4 storey structure. By sourcing an alternative to the use of timber, wastage was further reduced by avoiding the need to dispose and remove off-cuts and concerns over dust contamination and noise pollution were eliminated.

Litesteel Beam (LSB) is manufactured with an Aluminium Zincalum (AZ+) surface coating finish which provides a high level of atmospheric corrosion protection, ensuring that lifecycle performance for the floor joists was able to be maintained in this harbourside location.

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PREFABRICATION, DEMATERIALISATION & DEMOUNTABILITY

One of the main features of this 6-Star Green Star rated building is prefabrication, which has several environmental sustainability benefits, including: waste minimisation and water and energy reduction.

Firstly, prefabrication of the structural steel, wall, roof panels and floor joists allowed waste minimisation by providing a framework for a straightforward process between internal and external trades (i.e. the wall and roof panels join using standard clips). This in turn allowed the building's roof, wall and structural components to be developed with zero wastage.

Additionally, the demountability of the home through the use of prefabricated wall and roof panels is a unique feature that highlights the focus on sustainable design principles. Due to the componentisation of the design, the building can be demounted, flat packed and moved to another site. Some of the product components include: precast insulated concrete wall panels, timber framed windows and COLORBOND® roof panels, all of which are easily moved and reassembled.

RECYCLABILITY & DESIGN FOR LONGER LIFE

Not only is the home demountable but the building's design allows it to be easily recycled piece-by-piece and constructed with other sustainable applications in mind. For example, the timber off-cuts from construction were stored onsite for burning in the slow combustion fireplace and the solar screens are made from plantation hardwood.

Additionally, the house has many design features that culminate to enhance the building's environmental adaptability. These include: supporting the National Accessibility Initiatives by accommodating for an ageing occupant with wider doorways, ramps and accessible amenities, a bungalow for younger family members, allowance for additional floor space above the living room and also flexibility for the building to be extended and interiors converted into dual units for leasing on the site.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by VDM Consulting Structural Engineers, for the inaugural 2009 ASI Sustainable Steel Awards

"The facility will put tennis in Queensland back on centre court after a decade on the sidelines. This is a significant day for all Queenslanders, but especially for the tennis fans and players as the opening of this magnificent tennis centre will revitalise the sport in this state."

Anna Bligh, Queensland Premier - at the opening of the Centre in January 2009,

USE

SINCLAIR KNIGHT MERZ - QUEENSLAND TENNIS CENTRE

SIMON MAY & ASSOCIATES worked with architects Populous to meet the Queensland State Government's requirement for an $82 million state-of-the-art, fully roofed tennis centre that caters to dynamic weather conditions experienced over summer. The Pat Rafter Queensland Tennis Centre is the first naturally ventilated, roofed tennis stadium in the country, and stands as the long awaited home for Queensland tennis to host the Brisbane International Tennis Tournament. The Centre considers sustainability points of energy reduction and water minimisation to position itself as a landmark currently demonstrating how sustainability can become reality.

ENERGY EFFICIENCY & ADAPTABILITY

Designed as an 'open air' stadium, the facility allows natural ventilation and lighting to maximise thermal comfort for players and spectators and to minimise energy use. The design included architecturally designed steel louvered screens to the north, wast and west perimeters to avoid shadowing of the centre court and maximise ventilation. This was achieved through the design of a steel roof of 85m x 85m, which has key elements including: the upper roof and lower roof with triangular trusses for support.

The upper roof uses a translucent fabric for not only aesthetic appeal but also to provide natural light and shade to the stadium. A central fabric valley steel cable to control the shape of the fabric under strong wind pressure supports this section. By undertaking a wind analysis, it was found that the cables would also minimise the sectional truss sizes and therefore reduced the amount of steel required in the structure. This allows thermal comfort for players and spectators and was achieved by employing a roof to maximise cross ventilation and a raised central fabric roof to allow hot air to escape.

The lower metal clad roof was required to incorporate a ceiling that was maintenance free, clean and an acoustic barrier to minimise noise distraction. To that end, a sandwich panel roof system was determined to be the most cost effective method of construction and an acoustic ceiling system to reduce break of noise and balance reverberation control for the 5500-seat court was quickly lifted into place.

The triangular trusses and box rafters used to support the upper and lower roofs were also an integral part of the structural design and combined to deliver a sustainable roof system. Fit out materials were subject to life cycle reviews a highlight of which includes the use of post-tensioned concrete with a specified minimum 20% cement replacement with industrial waste (slag).

Through ongoing sustainability consultation with SKM the Centre is comparable with Ecological Sustainable Development (ESD) benchmarks through effective design for climate conditions such as wind, rain and humidity, the selection of ecologically sustainable materials and water management.

WATER MINIMISATION

Although the construction of the Centre occurred during a drought, which meant that government restrictions were complied with, the process did see the overall conservation and reuse of water. Water is collected from the stadium roof and outside courts via symphonic and gravity fed systems to an underground tank designed by SKM, now located beneath the site's recreation area to feed irrigation of landscape and grass and clay courts, a concept that adheres to the Water Retaining Structures Code.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by SKM, for the inaugural 2009 ASI Sustainable Steel Awards

USE

S² CORPORATION - AUSTRALIAN EQUINE & LIVESTOCK EVENTS CENTRE AND BOEING AIRSPACE

S² CORPORATION (S²) specialises in the design and implementation of large span facilities and uses a patented post-tensioned steel technology to service its niche market. There are two examples of projects that highlight both reducing steel's footprint on the environment and turning sustainability into reality known as the Australian Equine and Livestock Events Centre (AELEC) and Boeing Airspace Hangar respectively. Both of these projects align with modern sustainability practices as products to position the innovation demonstrated by S² as one of the industry's current best practices.

AELEC was a $28 million project in which S² designed and engineered a building with seating for up to 5000 people (60m span), an additional warm up area catering for 660 people (42m span) and six stable buildings (25m span each). S² employed a series of structural design concepts, economy considerations and demonstrated practicality in fabrication and erection to develop an environmentally smart and sustainable facility.

ADAPTABILITY

AELEC features a number of sustainability attributes, which include adaptability, energy minimisation and recyclability. By creating vast areas of column-free space replacing traditional structures and column grids, S² enhanced the venue's adaptability. Due to the large seating capacity combined with vast open space, the AELEC can easily be converted into a dynamic entertainment venue. In practice, the AELEC has already proven a success since opening in Tamworth in 2008 as the venue is full nearly all year round and supports the area's burgeoning $45 million equine and livestock event industry.

DEMATERIALISATION & ENERGY EFFICIENCY

The structure's post-tensioned steel solution facilitated the reduction of up to 40% in the overall weight of steel compared with similar designs. This saw beneficial impacts across fabrication and assembly process and because of the ability to store energy an increased span is possible. By using this technology, the structure's steel tonnage is approximately half the weight of regular projects that sees advantageous environmental benefits across manufacturing, fabrication and delivery supply chain by keeping truck movements to a minimum. Furthermore to reduce waste and carbon emissions, the entire steel elements of the structure are 100% recyclable.

Boeing airspace is another example of intuitive sustainable design and engineering by S² done with the purpose of sheltering large aircraft for Boeing in Amberley (Queensland). The resulting roof product is known as 'airspace' and stands at 14.2m tall and 67.5m across the length and width.

RECYCLABILITY

The airspace's lightweight and demountability are features that allow the structure to overcome challenges, which were to ensure the cover fit between two existing buildings and allow aircraft access from three sides, which was considered in design and practical assembly.

As seen in the AELEC, airspace's post-tensioned steel solution results in an approximate saving of up to 40% in overall steel weight, complete recyclability of the steel structure, adaptability elements and prefabrication.

All information contained in this case study was gleaned from the submission presented to the Australian Steel Institute (ASI) by S² Corporation, for the inaugural 2009 ASI Sustainable Steel Awards

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