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Jane Foss Russell Building University of Sydney

A City within a City

The newly named "Jane Foss Russell Building" is a key component of Sydney University's Building for the Future Program. Already a major University and city landmark, this 12,850 square metre, seven-storey building provides centralised accommodation for a wide range of student administrative services together with commercial and retail spaces. Not only does the development service the needs of students living on and around the campus but it also engagingly services the residents of the surrounding areas.

The building was the subject of an international design competition conducted by Sydney University in 2003. The competition winner, John Wardle Architects, was formally awarded the commission for the design of the building in December 2003. The construction contract, the largest infrastructure contract in the University's 158 year history, was awarded to Abigroup Contractors.

As John Wardle explains: "The overarching theme of the building is linkage. Sydney Central is positioned at the intersection of the Darlington and Camperdown campuses and forms a link between the landscaping currently underway on both campuses. In addition, it will form a link between the different student groups at the University and the community with its large and vibrant plaza area."

Visually appealing from every angle, the building vision of a 'city within a city' for students, staff and visitors features a large outdoor plaza with tiered seating, function space and cafes, interesting architectural themes and dynamic use of

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President's Column

We welcome the iniative of the Federal Goverment with respect to the school and infrastructure projects that are now commencing and this will provide a necessary stimulus to the construction industry. It is important that with this building construction stimulus we do not overlook the environmental obligations that we all need to target with this capital expenditure.

By using exposed precast concrete internally in buildings for walls and floors, the thermal mass benefit of concrete can be maximized. Concrete has an inherent ability to slowly absorb and release heat and can also provide a cooling effect for a structure and its occupants. This allows for constant internal temperatures to be maintained whilst reducing energy costs and thereby leading to a reduction in greenhouse gas emissions.

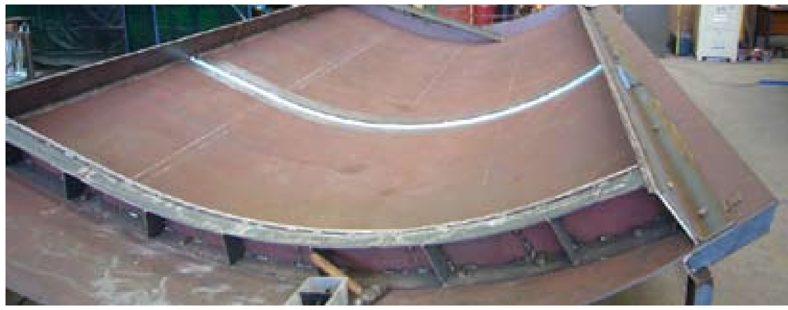
The thermal mass of concrete in buildings:

- Reduces heating energy consumption.
- Smoothes out fluctuations in internal temperatures.
- Delays peak temperatures in offices until the occupants have left.
- Reduces peak temperatures and can make air conditioning unnecessary.
- Can be used with night time ventilation to eliminate the need for daytime cooling.
- Can reduce the energy costs of buildings, thereby cutting Carbon Dioxide emissions.
- When combined with air conditioning results in significant energy savings.

In this current issue of National Precaster we highlight a number of projects demonstrating the efficient use of precast concrete to provide both energy and cost savings.

We trust these project profiles are of interest and invite our readers to forward information of other projects to further showcase efficient precast construction.

Peter Healy
President



… Jane Foss story continued from cover

building materials. External balconies, terraced areas extending between floors, bleachers and an assortment of sitting areas are incorporated into the building's design. These allow all users of the building to enjoy as much of the natural light and the spectacular views as possible.

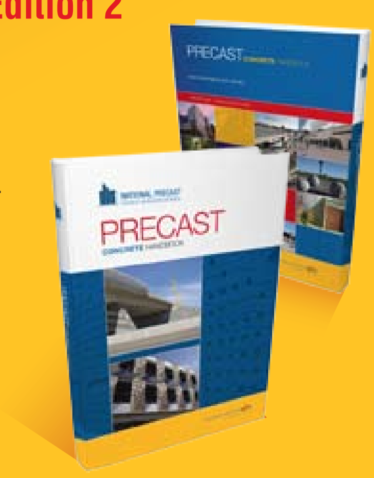
Precast concrete manufactured by Hanson Precast features in a multitude of surprising places, creating an attraction of forms and finishes:

- 82 polished white precast concrete panels made with feldspar aggregate and imported white cement. Nine of these were curved – both convex and concave.
- Unusual shaped flat and facetted façade precast panels, following the soaring façade facets of the building. Some of the precast elements have up to five polished surfaces at different angles.
- 79 expressive grey precast concrete vaulted external ceiling coffers as structure to the floors above.
- 25 patterned precast concrete panels cast using Reckli synthetic rubber form liners. These are displayed externally on two walls. The concrete for the textured wall panels uses off-white cement.
- The geometry of the buildings provides a vast array of panel shapes that are seldom seen on other architectural projects – demonstrating the design versatility of precast.
- A major consideration in the selection of precast concrete was concern over the possibility of vandalism and grafitti to this 24-hour open street-front facility. Polished precast is the perfect answer for such concerns.
- Steps and rooftop elements are in precast.

Jane Foss Russell Building – University of Sydney

Location: City Road, Darlington
Client: The University of Sydney
Project manager: Capital Insight
Architect: John Wardle Architects + GHD + Wilson Architects
Cost consultants: Davis Langdon Australia
Structural engineer: GHD
Façade engineer: Arup Facades
Builder: Abigroup Contractors
Precast manufacturer: Hanson Precast

A major objective was a 5-star green energy rating through environmentally sustainable design. All buildings constructed during the Campus 2010 program will be built according to the University's ESD Guidelines, utilising new technologies designed to minimise energy and water usage, and maximising recovery of waste materials. The building includes the use of low energy mechanical services. Chilled beams were also used to provide a passive air conditioning system and solar panels were installed on the roof.



Cimitiere House - 5 Star Green Building Stars Precast

Cimitiere House is Tasmania's first Green Building design and represents a fantastic opportunity for Launceston's business community. Committed to achieving a 5 Green Star rating design, this building is situated in the CBD, offers large tenancies and good parking, and is a wonderful environment for business owners and employees to work. The development provides four levels or around 4600m2 of office space, with the ground floor housing a café, retail tenancies and a car park.

Cimitiere House will set the standard for future commercial premises in Tasmania. An integral part of achieving this outstanding result is the inclusion of a precast concrete structure by project architects Glenn Smith Associates and project engineers Pitt & Sherry to incorporate numerous passive and low energy mechanical systems to produce a green building.

The smart design and fast construction features of the building permitted savings that can be allocated to more important areas such as sustainability and energy saving performance. Developer, Enmore Enterprises, say that tenants combining the energy saving potential with strategic energy management practices can theoretically save up to 70% on their power bills.

Victorian precast concrete manufacturer Hollow Core Concrete supplied 4,600 square metres of hollowcore precast flooring planks to the 5-storey building. Apart from the ground floor being in in-situ concrete, all remaining floors were in hollowcore to eliminate the need for expensive and time-consuming formwork.

Energy efficient, low cost heating and cooling

The selection of hollowcore precast flooring allowed the design team to incorporate an ingenious energy efficient heating, cooling and ventilation system that uses the high thermal mass of hollowcore flooring. The system works by distributing warmed or cooled fresh air through the hollow cores at low speeds, allowing prolonged contact between the air and the slabs. This enables the concrete to behave as passive heat exchange elements that release heat to, or absorb heat from, the air in the slabs. External temperature variations are not reproduced inside the building because the maximum heat level reached during the day is delayed by the thermal mass of the building until counterbalanced by the cool of the night.

In the case of Cimitiere House, cool air from the South side of the building is channelled through the voids in the hollowcore planks. The cool air is circulated through the hollowcore and is ducted into office spaces. During the day, heat generated within the building is absorbed directly into the exposed concrete slab. During the cooler months, solar heated external air ducts on the North side of the building provide partially warmed air that is passed over ceiling mounted hydronic radiators which are fixed to the exposed hollowcore soffits, providing warm air without drafts, thereby reducing energy costs.

Precast walls add to thermal mass benefit

The precast flooring in effect becomes an active component of a sophisticated energy management system aided by the additional thermal mass of the precast wall panels. As well as the precast flooring absorbing the internal daytime heat, the precast walls provide added benefit, also absorbing heat during the day. At absolutely no cost, they release the heat in a thermal delay cycle during the cooler night, providing comfortable conditions for the morning arrival of staff.

A total of 199 precast loadbearing wall panels, columns and façade panels were supplied to the project by Tasmanian precast concrete manufacturer Duggans. Loadbearing wall panels comprised the West and South elevations, while the attractive façade panels facing the street comprised the East and North elevations. Façade treatment and external finishes to the precast ranged from off-form, exposed aggregate, to polished architectural panels. The finishes to the precast were achieved with exposed structural aggregate, or polished where high quality architectural finishes were required.

Wall panels incorporated 20% slag aggregate from BHP's Temco plant at Bell Bay Tasmania to enhance the environmental aspect of recycling waste material.

Wall panels of size approximately 3200mm x 2800mm ranged in thickness – with 100mm, 150mm and 200mm (with corbel) being typical. The vertical joint detail incorporated grout keys at 600mm centres. Loadbearing panel fixing at floors use cast-in inserts with a topping slab cast into rebates. The panels were cast in Duggans' factory on steel tables, and achieved an initial concrete strength at lifting of 25-32 MPa.

The end result is well summed up by the State Premier David Bartlett who said at the opening: "Developments like this one will help to reduce Tasmania's greenhouse gas emissions from the built environment. Buildings which consider environmentally sustainable design are also usually healthier homes and healthier workplaces with increased productivity."

Cimitiere House Project, Cimitiere Street

Location: Launceston, Tasmania
Project developer: Enmore Enterprises
Architect: Glenn Smith & Associates
Project engineers: Pitt & Sherry (also Green Star rating accredited professional)
Head contractor: Fairbrother
Precast flooring: Hollow Core Concrete
Precast walling: Duggans

Note - Engineering Solutions Tasmania provided advice on energy efficiency measures for the development.

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Environmental features that make for an outstanding building

- Cimitiere House has been designed to be a healthy building with clean, fresh air, helping staff stay happy, alert and more effective at work, increasing productivity and reducing sick days and staff turnover.
- The development has been registered as a Five Star Green Star development under the Green Building Council of Australia's Green Star rating tool (Office Design).
- The Green Star assessment process evaluates building projects or existing buildings against eight environmental impact categories (management, indoor environment quality, energy, transport, water, building materials, land use and ecology, emissions). The assessment process also takes innovation into consideration.
- The atrium and a series of outdoor spaces are available to share and mingle with clients and adjacent businesses.
- The building uses natural light, recycled water, solar-generated heating and Tasmanian recyclable building materials.
- There is a low level of power usage and reduced air emissions, making use of natural cross-flow ventilation. No air-conditioning is needed.

Glenn Smith, the architect behind Cimitiere House, found that building green office space can be more economical than building conventional office spaces.

"Although Cimitiere House wasn't the first environmentally aware building we have designed, it is the first opportunity we have had to design a building specifically aimed at Green Star registration and to meet all the criteria. By working with local consultants and contractors, we were able to meet the Green Star criteria at a cost equal to or better than conventional office construction here in Launceston. At around $1600 a square metre it proves that it is affordable to build green and attract a larger number of quality tenants," Mr Smith said.

…Using Precast for Sustainable Construction story continued from page 5

Recycling of concrete waste

The Australian Greenhouse Office encourages and rewards builders and designers to give due attention to the use of a significant recycled content in building construction or refurbishment. Concrete waste can be processed to produce roadbase/fill material, recycled concrete aggregate and recycled concrete fines. Extensive research has been undertaken to increase the use of recycled concrete worldwide. The primary use of recycled concrete in Australia is for roadbase material, which not only reduces the need for natural fill but is also commercially viable.

Use of supplementary cementitious materials

The quality and properties of concrete can be improved by replacing a portion of the cement with industrial by-products known as supplementary cementitious materials (SCM) such as fly ash, blast furnace slag and silica fume. Use of these materials also reduces both mining of natural resources and greenhouse emissions associated with cement production while disposing of a waste material previously destined for landfill. Fly ash is commonly used to replace between 20–25% of portland cement in a blended cement, although higher percentages are possible and could be adopted where appropriate for a greater impact.

Increase the use of recycled water in concrete

Recycled water has been successfully used in concrete for many years. Its use, quality and limits are assessed under AS 1379. In addition, finishing processes such as polishing and honing can use recycled water.

Improving building design and specifications

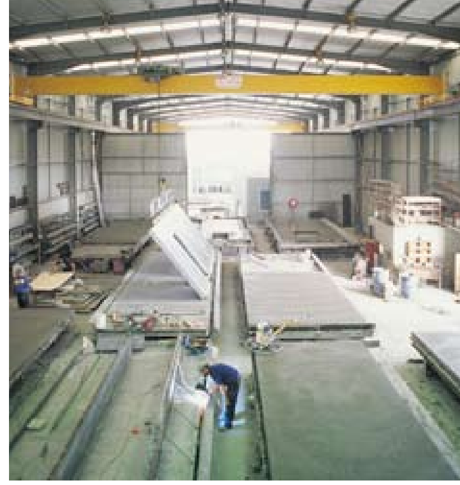
This involves:

1. Developing low-energy, long-lasting yet flexible buildings and structures;
2. Exploiting the thermal mass of concrete in a structure to reduce energy demand;
3. Considering innovative or alternative design that incorporates de-materialisation such as using materials that have undergone an energy-saving process or action during manufacture or sourcing such as a filler component in cement manufacture.

Specific examples of where sustainable design using precast construction, can make a considerable environmental impact can be found in the second edition of the Precast Concrete Handbook, on sale soon from SAI Global – register at www.nationalprecast.com.au to be notified of availability.

Precast's sustainability benefits come from every angle…

- Lean manufacture, superior vibration and curing, steel casting beds, special mixes and recycling of waste means a higher quality product with minimal production waste.
- Moulds are often used repeatedly.
- Local materials are used, transportation is minimised.
- Recycled materials (eg fly ash, slag, silica fume, recycled aggregates, grey water) can be incorporated.
- Precast construction creates less air pollution, noise and waste (exact elements are delivered to site).
- Precast can be left exposed, maximising thermal mass benefits.
- Precast has a long life expectancy and maintenance and operating costs are low.
- Precast structures can be retained and refitted internally.



Using precast for sustainable construction

Sustainability is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It encourages the protection of the environment and prudent use of natural resources. Sustainable development challenges the design and construction industry to create buildings and structures that acknowledge the life cycle of the structure.

With buildings, recognising that operating a building over time is far more energy intensive than developing it, demand for durability and energy performance is growing. Greenhouse gas emissions in buildings are due to both embodied energy and operating energy.

The importance of material choice

Choosing the right materials is a key consideration in sustainable construction. When compared with other construction materials, precast concrete is a responsible choice for sustainable development. The underlying properties of precast make a strong contribution to sustainability. Architects, engineers and builders are choosing precast for its durability, reduced maintenance and energy performance; properties not found in other construction materials like steel or timber. Benefits of using precast come from every angle… efficient manufacture, on site (during construction) and for the life of the building.

Design and manufacture

Because AS3600 recognises the high quality of precast concrete, it rewards the user of precast concrete with reduced concrete cover to reinforcement and the physical size of precast elements can be reduced by up to 15% when compared with in-situ concrete. In addition, most precast concrete flooring systems offer savings of up to 50% in concrete and reinforcing steel due to the structural efficiency of their voided or ribbed cross-sections. These dematerialisation advantages offered by precast are indeed a benefit to our environment which can be easily overlooked.

ABOVE LEFT: Off form precast manufactured by Westkon Precast has been left exposed for minimal maintenance in the Caroline Springs Library and Community Centre. Whilst a painted finish was specified, the architect was so impressed with the off-form finish that the specification was changed.

ABOVE RIGHT: Precast concrete is manufactured in a controlled environment allowing more efficient use of materials with very little waste.

LEFT: ANU's Hedley Bull Centre - repeated use of moulds and specially designed mixes mean a higher quality product with minimal production waste.

Precast concrete is manufactured in a controlled environment allowing more efficient use of materials with very little waste compared with in-situ concrete.

The advantage of controlled manufacture becomes apparent as each part of the process can be easily monitored and controlled due to the operations being repetitive. Employment of lean production methods and sophisticated quality systems in the factory, as well as superior vibration and curing techniques, steel casting beds, repeated use of moulds and specially designed mixes mean a higher quality product with minimal production waste. The minimal waste which is generated in the factory is more readily recycled because production is in one location.

To reduce the use of virgin materials and the overall environmental burden, recycled materials such as fly ash, slag, silica fume, recycled aggregates and water can be incorporated into precast concrete. Use of such products diverts them away from otherwise being added to the growing landfill mass.

During construction

On site, precast construction creates less air pollution, noise and debris. Local materials are often used and transportation is minimised. Formwork is reduced or eliminated and buildings can be erected quickly. As well, site waste is significantly reduced as exact elements (in both size and quantity) are delivered to the construction site.

Post construction

What happens after construction can also make a solid contribution to sustainable building strategies.

Precast's high quality means that it can be left exposed in order to maximise the benefits of its inherent high thermal mass. Because of its high density, precast has the ability to absorb and store large quantities of heat. This in itself may improve heating and cooling efficiency by as much as 30% compared to other building alternatives.

Further, the high quality and integrity of precast means that maintenance and operating costs are low. For minimal on-going maintenance, precast can be left exposed (with finishes such as off-form, sandblasted, water-washed, honed, polished, coloured with oxides or stained). More durable than other materials, precast provides long service for high use applications and can easily have a life expectancy of 100 years.

When the time does come to reuse or renovate a precast structure, its durability means that the main portion of the structure is very often left in place. This helps the environment by conserving resources as a result of reduced waste (which otherwise goes to landfill) and avoiding the environmental impacts of new construction.

Increasing the sustainability of precast

Although concrete has a high level of embodied energy, designers and builders can adopt the following options to reduce embodied energy and make it more sustainable.

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Profile: An Engineer shares his thoughts on using precast

Engineer Andre Vreugdenburg at PT Design in Adelaide shares his thoughts on using precast concrete walls and floors, particularly in his own new offices:

Q: How did you get started using precast?
A: In the early nineties, we started designing precast structures, winning three awards in 1994, so we've stuck to a winning formula. The economics and construction speed of precast mean that designing precast wall panels is now a daily activity – probably the principal activity in our office, PT Design.

Q: Why do you like precast and also why did you choose to use precast for your new offices?
A: Precast is a structural system that is considered during the preliminary engineering design phase alongside other conventional steel and in-situ concrete systems.

In our new office building, a real benefit of precast flooring is the long-spanning ability to eliminate conventional concrete beams and therefore the need for formwork during construction. And post construction, column-free space is a real plus allowing flexibility for future use… something which is a major asset in terms of attractive lettable space. The Ultrafloor was able to clear span 11 metres and also was able to satisfy the fire rating requirements. This system provided the thinnest overall structural solution. The available space between the beams was used to advantage for hydraulic pipework to minimise ceiling space.

Q: Can you describe other structural aspects of your new offices?
A: The design of the entire structure was a simple exercise by PT Design – basically using precast walls and floors virtually as a 'kit-of-parts'.

In order to complete a building, conventional construction methods require an enormous number of individual components and trades, all needing handling, placing and scheduling, and that adds to the complexity. With precast the process is so simple.

The structure includes one polished entry panel and 17 grit blasted façade panels using Brighton Lite cement. 81 off form grey loadbearing panels of 150mm thickness were manufactured by Hicrete Precast for the internal structure, Southern and Eastern elevations. The cast in support angles allowed the flooring to be placed as soon as the walls were erected and plumbed. The flooring was installed in one long day, approximately 10 hours per floor. In all there were 2,500 square metres of precast flooring over 4.5 levels. The basic structure was completed in approx 4 months.

We estimate that cost savings of 10% of the structure costs were achieved by using precast walling and flooring. This cost saving does not include the cost benefits of having tenancies occupied at least six weeks earlier than in-situ concrete would have permitted.

Q: What about aesthetics?
A: We love the look! On floors with exposed soffits we used the metal pans in the precast floors for reflectivity and appearance. We were very pleased with the finishes we achieved – shiny metallic handrails, ducts, lighting, etc for a theme which was already set by the shiny metal pans in the precast floors. All services were exposed.

Q: Having selected this precast flooring system for your offices, would you use it again?
A: Yes, most definitely! We were a little worried about acoustics but these were good when the furniture was installed. Once fitted out there are no acoustic issues apparent. We were very pleased with aesthetics, buildability, cost and performance absolutely. One of the most pleasing outcomes was the floor vibration performance.

Q: What has been your most interesting/ challenging project using precast concrete flooring?
A: Apart from long span applications, generally more than 9m, we have used this particular precast flooring system in tight spaces as a vertical basement retention system, which we believe has not been used in that application elsewhere.

Q: Where do you see the future of precast engineering heading?
A: Over the years, precast has become more common place in Adelaide, as costs and construction/buildability issues indicate that precast has considerable advantages over conventional systems.

Precast flooring systems are renowned for their long spanning ability – up to 18 metres in some instances. Refer Table 2.2.1.1 Comparative Spans for Floor Systems in the second edition of the Precast Concrete Handbook – available soon from SAI Global – register at www.nationalprecast.com.au to be notified of availability.

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