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# Precast integral to students' community atmosphere

Completed in June 2009, the new University of Canberra Student Residences include 507 bedrooms throughout 18 buildings and a common facility building.

In collaboration with the University of Canberra, May & Russell Architects aimed to develop a distinctive architectural design that enhances and extends links between the new and existing residences and to the campus itself. The design strongly focuses on the qualities of "neighbourhood" and "community" leading to the creation of a village atmosphere. This design intent is enhanced by the selection of precast concrete for the external walls of all buildings that comprise the residences, with the precast walls providing an appropriate solid masonry feel to the development. The external finishes to the panels were carefully selected to achieve this aim, using an interesting application of both formliners and staining to selected areas of the external wall faces.

## Formliners for textural difference

The use of synthetic rubber formliners supplied by Reckli provided textured surfaces to the precast and helped to provide an interesting texture to the end wall elevations of the various residential buildings. Due to the recurring form of the buildings, the use of formliners enabled the different buildings to be distinguished from each other as it was possible to easily vary where and how much formliner was used on each elevation. The infinite possibilities and detail that can be achieved with formliners made it possible to create a great façade that was both dynamic and different.

## Semi-translucent colour with outstanding durability

A critical client requirement stated that if precast concrete construction was utilised, it was not to require painted finishes that would entail future maintenance at some point. Precast concrete with a stained finish satisfied the client's brief for a robust and durable material requiring minimal maintenance. Concrete staining as provided by Nawkaw was the solution as it offers a choice in colours, is guaranteed for 30 years and is UV resistant.

Colour was a major aspect of the design and staining enabled key elements of the buildings such as the balconies, blade walls and stairs to be highlighted with feature colours, enhancing the individuality of the various residential buildings. The specifications required a soft neutral semi-translucent finish for grey precast elements, to provide colour whilst maintaining the smooth grainy texture of the concrete. A natural, durable colour in warm off-white was applied.

## Precast perfect for unique design

The low rise profile of the buildings suited the use of precast concrete panels. A unique design result was possible through a combination of similar structural forms in slightly different configurations, mirroring and rotations, whilst still ensuring panel repetition during manufacture.

**story continues on page 3…**

# Total Precast Structures can deliver surprising benefits

Total precast structures are becoming more widespread throughout Australia. In today's competitive construction industry, time is critical… delays and downtime cost money. Total precast concrete building systems are becoming a popular choice for many construction projects. Now widely regarded as an economic, structurally sound and architecturally versatile form of construction, total precast combines the benefits of very RAPID construction and high QUALITY materials with the advantages of production line economy and quality assurance.

Total precast structures are being used for many types of structures including apartments, parking structures, retail developments, offices and industrial buildings. Architectural and structural precast concrete components can be combined to create entire ENERGY EFFICIENT buildings. This design approach can take several forms, including precast columns and beams with panelised cladding or load-bearing precast walls, precast floors, precast service cores and precast stairs. The use of total precast in a structure offers fast construction, structural stability and enhanced fire resistance. A wide range of options is available for creating the perfect system to achieve the size and shape of building required.

**story continues on page 2…**

**Total Precast Structures… Story continued from page 1**

## Total Precast Structures: the benefits

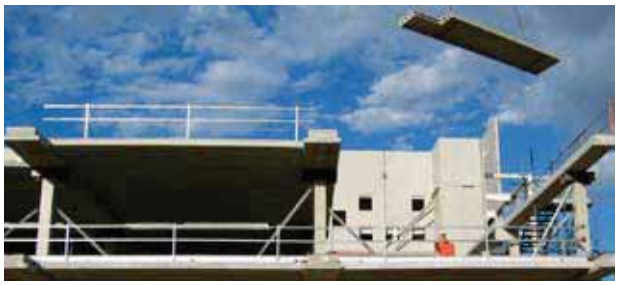
- Shop drawing process eliminates on-site surprises
- Smoother design process
- Off-site manufacture means less time on-site
- Reliable supply of elements – not weather dependent
- Quality assured products
- Fast erection, with highly skilled erection crews
- Following trades gain earlier access
- Simplified construction (less trades)
- Longer spans mean flexible floor layouts and column-free space
- On-site safety more manageable
- Possibility of a one-stop-shop for the whole structure
- Design assistance provided to consultants
- Maximise benefits of thermal mass
- Durable, maintenance-free, long life structures
- Design freedom

PLUS all the proven benefits of precast concrete construction.

## Total precast design considerations

On any total precast structure there are a number of critical design features that have to be addressed at the outset, including ceiling heights, load bearing walls, accommodation of lift boxes and some of the unique façade elements, in particular balconies. Once it is determined that the quality, safety and other requirements around these meet the brief, the design team in conjunction with the precaster is in a position to start fine tuning. The rest of the design refinement is centred around those issues. The essential requirement for any total precast project is to allow adequate lead time to allow such refinement.

Interior design flexibility is provided by long span precast concrete flooring systems that help building owners adapt to changing client needs in future years. Precast flooring systems can span up to 17 metres to minimise the need for interior columns required with in-situ systems. Precast also provides high loading capacity at little added cost.



## Projects convert to total precast

Across Australia there have been hundreds of structures completed over the last decade where precast columns, beams, walls and floors have been utilised. Current significant projects being constructed in Melbourne include Melbourne Airport T2 departures lounge extension and the David Jones Redevelopment in the CBD. Both projects have been undertaken as a result of the project parties wanting to look beyond the previous in-situ construction methods and asking how construction methods may be able to be improved. On the Melbourne Airport T2 project the use of precast flooring has allowed the installation of the baggage handling system to commence and be completed several months earlier than would have been the case had an in-situ concrete frame structure been utilised. Similarly at the David Jones site the critical following trades are completing the fitout of the structure which would be restricted by formwork support systems with other construction systems.

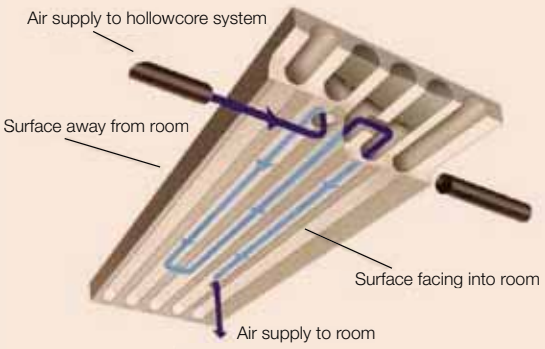
## Using a total precast structure's thermal mass to sell tenancies

By demonstrating that a structure is very energy efficient, building owners can sell significant cost savings to potential building occupants. This has been a contributing factor in convincing many developers to choose precast as part of sustainable design.

As the building fabric becomes an increasingly important aspect of low energy design, precast elements are being incorporated into building design because of their thermal mass benefit. Total precast structures have the inherent advantage compared to in-situ structures, in that the thermal mass of the precast structure can be utilised to reduce the energy consumption of the building.

The high quality of precast means that precast walls, floors and structural elements can be left exposed for maximum thermal benefit.

In particular, precast flooring is no longer regarded as a purely structural element offering long spans – it is now also contributing to the thermal performance of buildings. Hollowcore flooring can be used to distribute heated or cooled air and provide natural ventilation to the occupants. Not only does this reduce the capital cost of the mechanical ventilation systems, but it also reduces greenhouse gas emissions.




## Deakin University uses hollowcore to reduce energy costs

The Science & Technology Building for the Deakin University Burwood Campus has been designed using ESD principles. It is a three storey naturally ventilated building, orientated in the north-south direction with a central, full-height atrium running full length, east to west.

The floor system consists of hollowcore concrete planks with interconnecting channels. Air inlet and outlet holes allow ventilation air, at the rate of two changes per hour, to be reticulated through the hollow core slab from the atrium prior to entering the work areas.

In summer, the hollowcore floor slab is recharged at night by making use of cooler night time temperatures. The atrium is recharged using the same, cooler, night time air temperatures. Making use of the stored energy within the floor slabs, the recharged atrium air provides cooled ventilation air for the following day. The effect of this is to eliminate the need for airconditioning. In winter, heating is achieved by way of fan coil units that heat the ventilation air prior to forcing it through the hollowcore floor slabs. This heats the slab in a similar way to hydronic or electrical coil type slab heating but is much more responsive.

**Ongoing community project**

When completed, the new Temple and Stupa will cost in the vicinity of $8 million. Construction began in April 2007 with staged structural completion by February 2008, and with final completion and fit-out to be achieved by December 2009. A challenging aspect of the construction was the need to stage the work due to budgetary constraints as the funding was derived from voluntary community donations. Compounding this, the structure had to be installed on specific dates to suit the community's festivals.

# New Buddhist temple uses total precast structure

The new Quang Minh Temple for the Vietnamese Buddhist community is more than a place of worship. Situated at Braybrook, about twelve kilometres west of Melbourne's CBD, it includes a Community Services Centre and is arguably the largest centre for the delivery of community services in the area.

The Quang Minh Temple's structure is notable for its intricate building shape that required specialised precast elements of various shapes and sizes.

A requirement of the building was to have a large clear column-free span hall at ground level. Hence a total of 16 'Super Tee' prestressed girders were used to provide the required span of 24.6 metres. The large span was achieved with an overall structural floor depth of one metre, the Super Tees being 900mm deep with 100mm of topping.

Floors elsewhere in the building were constructed using 200 and 300mm deep hollowcore floor planks, allowing fast completion of working decks while removing the need for scaffolding. A total of 2,000 square metres of hollowcore was placed over several levels. Smaller areas of flooring were constructed in 120mm special precast floor planks. All together the precast flooring systems totalled 3,500 square metres.

Some 3,500 square metres of structural precast concrete wall panels, in thicknesses of 150, 175 and 200mm and in a multitude of intricate shapes and sizes were supplied. Jointing between panels was generally caulked flush to conceal the joint for a homogenous wall appearance. The superior factory finish was achieved on steel casting beds. Erection of wall panels was aided by sequenced precast deliveries and well detailed installation methodologies to construct the building in the most efficient manner.

The curved precast beams totalling 110 linear metres that were constructed in sections over the main entry stairs were a very visible item that required careful flush jointing and clever concealed connections. The beams are supported by imposing circular precast columns which emphasise the grandeur of the 23-metre high structure. Over 60 precast concrete columns are used in the building, ranging from 350x450 mm rectangular and 450x450 mm square columns; together with circular columns of 350 and 450 mm diameters.

The entire structure of the building was made from precast concrete elements, which were designed, manufactured and erected by Westkon Precast. By designing the total structure, any difficulties were ironed out well before anything occurred on site, therefore providing total assurance to the building owner.

**Quang Minh Buddhist Temple**

**Location:** 18 Burke Street, Braybrook, Victoria
**Owner:** Quang Minh Temple Limited
**Architect:** Nam Sanh Tran Architects
**Precast Structure Design, Certification, Manufacture and Erection:** Westkon Precast

**…story continued from page 1**

Due to the significant height variations across the site, the topography of the site also suited precast panels, as panels were able to be craned into position without disrupting the progress of civil works. Manufactured by Girotto Precast, the precast panels were used in a vertical format. This enabled the external envelope of the buildings to be erected in a matter of hours, fast tracking the building process, thereby reducing the construction programme and ultimately enabling an earlier practical completion date to that previously proposed under the original construction technique.

**Key environmentally sustainable design initiatives include:**

- Solar photovoltaic cells
- Grey water treatment and re-use to laundry
- Double glazing
- A well insulated building envelope (R2.5 walls, R4 roof)
- Cross ventilation including fanlights to bedroom doors and corridor ventilation
- Hydronic in-slab heating
- Building orientation: solar heating of all living and kitchen spaces
- External sun shading screens.

**University of Canberra Student Residences**

**Location:** University of Canberra, Bruce, ACT
**Client:** PBS Building
**Architect:** May & Russell Architects
**Engineer:** AWT
**Precast Manufacturer:** Girotto Precast

# Precast delivers on largest infrastructure project ever undertaken by WA Main Roads

**As the largest infrastructure project ever undertaken by WA Main Roads, the new $705 million, 70.5 kilometre New Perth Bunbury Highway is expected to greatly benefit West Australians by enhancing efficiency and accessibility of the State's road network.**

The Southern Gateway Alliance partners had specific project performance criteria that had to be met. They required a high quality standard in terms of both product and documentation, whilst achieving a very tight construction programme.

In June 2007, after some months of working with the Southern Gateway Alliance design team, Delta Corporation was awarded the supply contract for 146 precast prestressed concrete 'TeeRoff' bridge beams for the 15 major bridge structures on the Highway. Delta worked with the SGA's construction and design team to develop a product that would meet budget constraints and the production schedule whilst achieving the project construction programme. In addition to the supply of the 'TeeRoff' beams, the company was later awarded the supply contract for over 3,000 parapet precast panels for the project. The total contract involved 14,375 tonnes of concrete, 1,015 tonnes of reinforcing steel and 450 tonnes (or 375 km) of 15mm stressing strand - the single largest and most challenging supply contract ever undertaken by the company.

## State of the art manufacturing

Production of the 146 precast prestressed concrete beams weighing between 65 and 140 tonnes commenced in September 2007.

Two high capacity stressing beds capable of stressing loads of up to 1,200 and 2,000 tonnes respectively were utilised to manufacture the beams. The two fully adjustable steel moulds were specially designed, and equipped with external vibrators to ensure maximum concrete compaction. The moulds were enclosed in temperature controlled steam curing chambers to ensure high early strength to enable de-moulding the following day.

Fully automated computerised concrete batching and mixing equipment ensured that the highest quality concrete was supplied. Once batched, the concrete was transferred to the moulds using an overhead travelling skip and gantry crane to ensure that the rate of concrete supply met the rate of placing. Once the placement of the concrete was completed, the beams were covered and steam cured overnight.

The following day the beams were removed from the mould using portal cranes (or mobile crawler cranes for those over 100 tonnes) and transferred to the storage area. The beams were loaded onto steerable jinkers utilising their inbuilt hydraulic jacking system or alternatively by mobile cranes.

Due to the limited storage available along the alignment it was an important requirement that the precaster provide a large hard stand storage area to accommodate storage of between sixty to seventy beams at any one time. A major capital works redevelopment programme was undertaken to upgrade the factory to meet the production rate and storage capacity demanded for the project.

## Seamless installation

All beams were delivered and stored on site in advance to ensure that once installation commenced there would be little risk of costly delays. Generally two mobile cranes were used for the installation of the beams which provided a safe and speedy method of installation. In most cases safety rails, formwork and fittings were fixed to the beams prior to erection. This provided a safer and more economical alternative to trying to carry out this work at heights.

All the objectives of the Alliance were achieved by the manufacture and supply of the precast elements in a factory environment off-site. The overall project was completed ahead of schedule and the end result has turned out a very impressive and outstanding project.

## New Perth Bunbury Highway

**Location:** Safety Bay to Lake Clifton, WA
**Client:** Main Roads Department of WA
**Head Contractor:** Southern Gateway Alliance (Leightons, WA Limestone, GHD & Main Roads WA)
**Precast Manufacturer:** Delta Corporation

As with all products manufactured by Delta, the beams and parapets were produced in accordance with a third party accredited Quality System to ISO 9001:2008. This has been in place and operational for over fifteen years. In addition a NATA Registered Testing Laboratory for all in-house concrete testing was utilised and together with a highly trained and experienced workforce, they were able to meet all of the performance criteria set by the SGA.

## Reputable precaster chosen in preference to on-site fabrication

In determining the most effective supply solution, the Alliance undertook a full cost evaluation to assess the merit of sub-contracting the manufacture of the beams to an established and experienced precaster, versus establishing a temporary production facility adjacent to the alignment near Pinjarra. The precast manufacturer had to clearly demonstrate that it had the production facilities, the requisite expertise and experience to provide the client with the confidence that it would meet the very tight construction programme and standard of quality specified. The SGA concluded that the establishment cost of an on-site facility together with the risks involved, made the award to a reputable precast concrete manufacturer a much more attractive option.

# Precast Concrete Handbook Edition 2

Student Edition Available


The Precast Concrete Handbook is the definitive Australian text covering the design, manufacture and installation of precast reinforced and prestressed concrete. It is an essential resource for every precast concrete project.

**The new second edition:**

- Has been revised to comply with AS3600 (2009) and other relevant revised Australian Standards
- Contains new technical data on a range of precast concrete elements including sandwich panels
- Provides information on using precast concrete in sustainable designs
- Explains design impacts caused by recent changes to the Building Code of Australia
- Contains data on the thermal performance of precast concrete elements
- Provides data on the acoustic insulation properties of precast concrete elements.

**Retail Prices (GST incl)***

| | |
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| Student Disk | **$77.00** |
| Book or Disk | **$187.00** |
| Additional Disks with Book/Disk purchase (each) | **$110.00** |

**Member Prices (GST incl)†**

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| Book or Disk | **$149.60** |
| Additional Disks with Book/Disk purchase (each) | **$88.00** |

* Additional charges will be made for postage and handling.
† Member prices available to Concrete Institute and National Precast members only.

For bulk sales enquiries (10+) please contact National Precast on (08) 8178 0255.

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# Award winning precast

Precast manufactured by National Precast Members has featured handsomely in two recent concrete industry awards programmes.

## Cement Concrete Aggregates Australia's **Public Domain Awards 2009**

**New Park at the former Water Police Site**
Pyrmont, NSW
*Winner of:* Best Overall Project
NSW State
Precincts (joint winner)
**Precast manufacturer:** Hanson Precast

**National Portrait Gallery**
Parkes, ACT
*Winner of:* Walls
ACT State
**Precast manufacturer:** Precast Concrete Products

**Caroline Springs Library and Civic Awards**
Caroline Springs, Vic
*Commendation for:* Walls
**Precast manufacturer:** Westkon Precast

**Hedley Bull Centre, Australian National University**
Acton, ACT
*Commendation for:* Walls
**Precast manufacturer:** Hanson Precast

**Exmouth Marina Footbridge**
Exmouth, WA
*Commendation for:* Bridges
**Precast manufacturer**: Delta Corporation

## Concrete Institute of Australia's **Awards for Excellence in Concrete 2009**

**National Portrait Gallery**
Parkes, ACT
*Winner of:* The Kevin Cavanagh Medal
Building Projects
**Precast manufacturer:** Precast Concrete Products

**Meander Dam**
Meander River, Northern Tasmania
*Winner of:* Engineering Projects
**Precast manufacturer:** Duggans Precast

**New Perth Bunbury Highway**
Perth to Bunbury, WA
*Highly Commended in:* Engineering Projects
**Precast manufacturer:** Delta Corporation

**Berry Recreation Hall**
Berry, NSW
*Winner of:* Building Projects
**Precast manufacturer:** Hanson Precast

**Bishops See – Stage 1**
Perth, WA
*Winner of:* Building Projects
**Precast manufacturer:** Delta Corporation

Diana Snape Photography

# Meridians of Precast
# Hedley Bull Centre

The new Hedley Bull Centre at The Australian National University was designed by Melbourne based firm Lyons Architects, who previously used precast on the award winning John Curtin School of Medical Research also at ANU. This successful use of precast led Lyons to further explore the boundless visual possibilities of precast concrete.

The centre, reported to cost $17.4M, is a four-storey hexagonal shaped structure with an enclosed atrium providing 4,000 square metres of space, including a 60-seat lecture theatre and a 100-seat auditorium.

The building's exterior is constructed from digitally designed precast concrete panels from Hanson Precast, with horizontal incised meridians, to reflect the meridians seen on world maps, appropriate symbology for an international centre.

The architect's specification for the external precast panels nominated off-white cement and white sand with a surface finish of class 2CX to AS3610 to achieve a consistent whiteness of the panels. The smoothness of the mould was also important with the architect working closely with Hanson to achieve the desired result. The important requirement of no post treatment of the panels was critical to the architect.

The 52 precast façade panels, each nominally 11 metres long by 3.4 metres wide and weighing 14-tonnes were manufactured from concrete moulds. The concrete moulds were produced from a coated polystyrene pattern that was shaped using a specialist profiling machine. The architect's design was supplied to the precaster in a 3D computer file that was translated by the pattern maker into CNC machine language that profiled the pattern for the production moulds. Concrete was then cast onto the pattern to manufacture the production moulds.

The panels were erected using a 90 tonne mobile crane directly from the delivery vehicles with the panels fixed to the in-situ concrete frame.

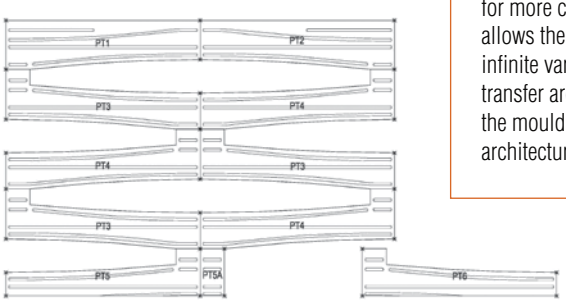
The result is that the precast façade on this building appears taut and fabric like, expressive of the plasticity of concrete, with a wonderful white finish. The precast panels are geometrically similar and significantly contribute to the thermal performance of the internal environment. The contrasting interior space is lined with Australian timbers which reference the wooded landscape of the ANU campus.

## Hedley Bull Centre

**Location:** Australian National University, Acton, ACT
**Builder:** Construction Control
**Architect:** Lyons Architects
**Engineer:** Bonacci Group
**Precast Manufacturer:** Hanson Precast

### CAD simplifies complex shapes

The role of the mould maker is important in the manufacture of architectural precast concrete. In the last few years the traditional mould making techniques of using flat pieces, usually steel, to produce moulds has changed. The advent of computer aided design and the demand for more complex architectural precast allows the architect to design an almost infinite variety of shapes. The ability to transfer architectural ideas electronically to the mould maker is now making complex architectural precast fast and affordable.



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**National Precast Concrete Association Australia**
6/186 Main Road Blackwood SA 5051
Tel [08] 8178 0255 Fax [08] 8178 0355
Email: info@npcaa.com.au
Executive Officer – Sarah Bachmann
**www.nationalprecast.com.au**