

# PRECASTER

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Photographer John Gollings

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## No vacancy

Environmentally sustainable design lies at the core of this project, one of the largest of its kind in the country and a far cry from the dark, poky lodgings often associated with student housing.

Comprising 19 buildings ranging from one to nine storeys, with various accommodation styles to house over 1000 students, the University of New South Wales Village project was an ambitious one.

Sustainable principles and passive solar design have influenced all aspects of the design, spanning choice of materials, orientation and a host of other features.

Integral to the project's success has been the intelligent and innovative treatment of its extensive precast elements, which helped deliver thermal efficiency, a flexible scope for future reconfiguration, speed of construction and a reduction of occupational health and safety issues as the project unfolded.

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### The 'sandwich solution'

With thermal efficiency high on the project's priority list, an innovative approach was required to ensure the precast components of the design would deliver.

"The original design always included precast," says Kerry Clare, director of Architectus, the project's architects.

"As architects, we are familiar with, and like to use, off-form concrete, however our concern in this case was that thermally, it doesn't perform well in a single skin application."

The solution was use of insulated, double skin, Thermomass sandwich panels which, according to Kerry, delivered much higher thermal performance.

"Sandwich wall panels which were typically 260mm thick were supplied, although 280mm and 310mm panels were also supplied," explains Chris Parsons, Manager for Hanson Precast, which was contracted to make and supply the precast components.

"The sandwich panels were manufactured 'inside out' with the structural layer poured first, the 50mm insulation placed and then the 60mm external concrete skin. The three layers were

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held together with non-conductive connectors or ties." The ties enable the layers to move independently of each other, allowing for thermal expansion and contraction of the external skin without affecting the structural integrity of the element.

All in all, 3100 wall panels – totalling 30,000 square metres – were constructed for the project, including 1200 of the sandwich panels.

Hollow victory

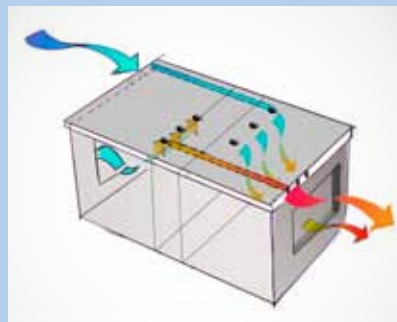
Also delivering on the thermal performance front were the 17,500 square metres of precast hollowcore flooring planks, which were topped with 70mm of in situ concrete.

To provide free-flowing ventilation, an energy efficient hollowcore cooling system was devised. Selected 1200mm wide floor planks had three 70 millimetre diameter holes drilled right through the cores and were then plugged and topped with the topping layer of concrete on the topside. The external ends of the floor planks were left open to the outside air and a fixed louvre was fitted at the ends to protect against rain ingress.

According to Chris Arkins, Director of ESD consulting firm Steensen Varming, "ventilating the slab in this way allowed absorbed heat to be purged overnight, enabling it to absorb heat

during the day and provide passive cooling to the spaces. The key outcome achieved was to allow cross ventilation to the bedrooms without compromising privacy."

Flexibility and timing the key



Energy efficient cooling using hollowcore - crossflow ventilation to double-loaded bedrooms via the hollowcore slab.

The relatively lightweight flooring and wall panels were prefabricated off site and brought in during the day, delivering significant savings to site costs, personnel and a reduction in associated OH&S risks. And use of precast panel construction will also enable relatively simple reconfiguration of the site should it be needed in the future.

That's not to say the logistics of the job weren't considerable.

Three Favco cranes were positioned on the site to provide sufficient lifting capacity and coverage. On any one day two cranes were used to erect the panels.

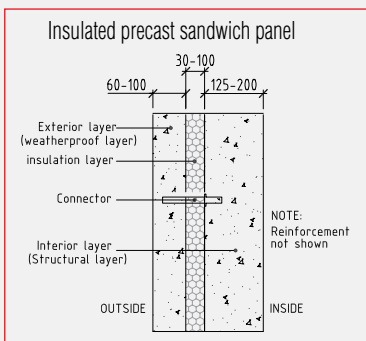
At the peak of the project the average number of precast elements erected each day was either 30 wall panels or 70 floor planks or a combination. This was maintained for approximately six months. And a typical day involved up to 15 semi trailer loads being unloaded – all deliveries that were critical to the project's success.

And certainly success is the word to describe this project – within a month of its opening for the 2010 academic year, it was fully occupied – truly the place to be on the UNSW campus.

UNSW Village

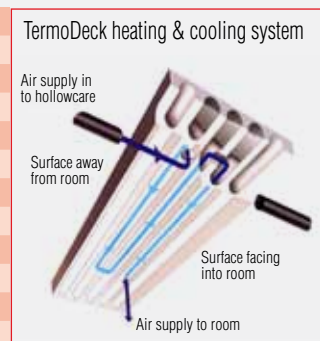
- Developer:** Campus Living Villages
- Architect:** Architectus
- Engineer:** Robert Bird Group
- Builder:** Watpac
- Precast manufacturer:** Hanson Precast
- ESD consultant:** Steensen Varming

Precast concrete... the SUSTAINABLE option



Energy efficient sandwich panels maximise thermal mass benefits

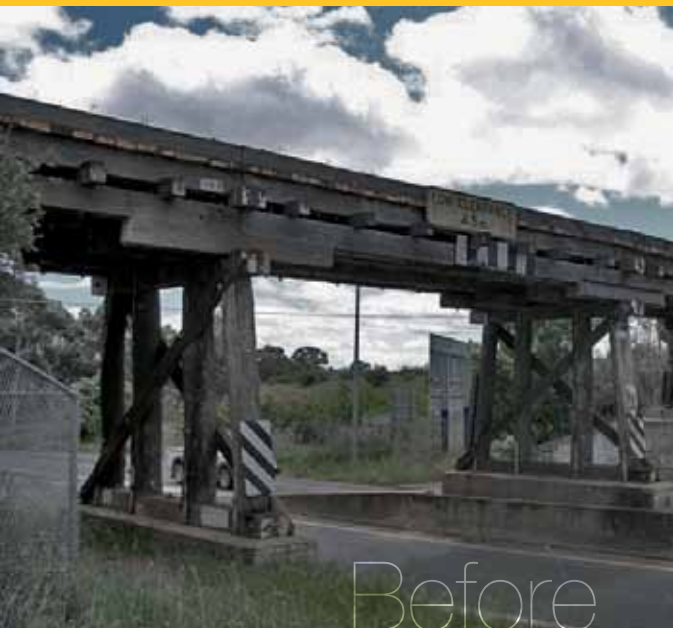
- Dematerialisation – precast uses less concrete & reinforcing
- Minimal waste – exact elements, waste reused in production
- Manufactured in re-useable moulds
- Resource reuse: flyash, slag, water, aggregate
- OHS benefits – less trades on site
- Less site air pollution, noise & debris
- Faster construction
- Local materials & supply – minimal transportation
- Absorbs CO<sub>2</sub>
- Durable and long life, reusable structures
- Low maintenance structures
- Energy efficient structures – thermal mass benefits



Energy efficient hollowcore heating & cooling systems such as TermoDeck maximise thermal mass benefits



## ■ Lateral thinking for fast track result



Replacing an ageing rail underbridge to challenging specs in a super short 60-hour timeframe called for lateral thinking and some highly coordinated teamwork.

The old, low clearance bridge in question was a 1940s timber ballast top spanning the Yass Road in Queanbeyan, NSW. The new bridge was to have both an increased 20 metre span to accommodate future road widening, and a higher clearance – increasing from its previous 4.1 metres to a desired 5.3 metres – but with no possibility of either lowering the road or raising the tracks above to achieve it.

Solving this problem required intelligent design and use of materials, and a variety of precast components filled the bill.

### The design solution

The designers opted for use of an external 'I' beam design – but that was the only standard part of the solution.

To maintain the existing rail level, a modified precast cross deck section was conceived, with use of 8 no. 1200mm diameter bored piles located outside the existing bridge structure, along with cast in situ columns to form the sub-structure. The headstocks and abutment beams were cast as high as possible under the existing bridge, while concrete packing beams gave the new bridge greater clearance.

### The need for speed

The need for speedy execution led to the use of a multi-contract approach. This reduced lead time – but also required a high level of co-ordination and teamwork between contractors.

Works were broadly divided into the sub-structure, site works and the precast superstructure, which was in turn divided in two.

One contract, for the conventional requirements such as standard rail girders, was awarded to Structural Concrete Industries for casting at its Teralba factory.

The contract for the specially designed components – the 20 metre girders and the cross decking – went to Waeger Precast.

### Precast with a twist

“Building complex 20 metre beams is a big ask in any project and was a very satisfying milestone for us,” says Karl Waeger, who oversaw the design and manufacture of the beams and decking.

“For the decking, although the rails had to be set low, the girders had to be set high. We used conventional precast principles and adapted them to create the cross decking with a small drop-down step in which to set the rails.

“It all came together exceptionally well, with all the components and contractors working to plan. We opened the road and the railway again within 60 hours and with a brand new bridge to show for it. It was a real achievement.”

### Rail Bridge - Queanbeyan NSW

**Client:** Australian Rail Track Corporation

**Design:** Opus International Consultants, Sydney

**Site works:** Bridging Australia and Track Australia

**Precast manufacturers:** Structural Concrete Industries for conventional rail girders; Waeger Precast for the main post tensioned girders, infill panels and cross decking



## Precast Pioneering the Revitalisation of Yagoona

A new apartment building is pioneering the urban revitalisation of the Yagoona Town Centre in Sydney's west, providing a colourful demonstration of the benefits of precast. Located in close proximity to a broad range of public amenities, the 39 residential units and single commercial space are contained in a building constructed almost entirely of precast.

Kane Developments, a locally based developer, were cemented to the use of precast through their experience on other projects in the financially stringent development context of Sydney's west. They knew that two of precast's inherent advantages over alternate systems – speed of construction together with an integral external finish – could substantially reduce the construction time and costs, which is important to the financial success of any project.

The marriage between precast walls and floors permitted a six day turnaround from floor to floor during construction.

### Form liners for fluted texture

The building's architectural expression embraces precast concrete's rich possibility of integral detail and texture. Structural precast wall panels feature a vertically fluted texture, using Reckli form liners. The form liners were limited to two widths to achieve a level of economy and efficiency (each liner able to be used up to 100 times), but texture was notionally stretched across larger widths with vertical reglets to achieve a broader and more animated composition. Further enlivening the building's elevation, horizontal reglets define each storey and rich red panels are separated by a neutral band at each floor. All this was achieved through careful coordination and communication between architects, precast manufacturers and builders during construction, expediting and streamlining construction, whilst maintaining the integrity of the design intent.

### Precast floors for long spans

The Ultrafloor system was selected as the floor structure, with simply supported 250C beams spanning 11.6m. Such large spans offered significant savings by deleting a line of internal load-bearing precast walls. The overall slab depth for these spans was 400mm and they only required a single row of midspan propping frames. An interesting innovation was the adoption of Ultrafloor's new permanent angle detail at all precast wall to floor connections, which is fire engineered so as not to require any traditional fire rating treatment.

The completed Dutton Street Apartments are testament to precast concrete's ability to achieve a high quality of finish, detail and construction, with economy and practicality.

### Dutton Street Apartments

**Developer:** Kane Developments  
**Head contractor:** JSN Hanna  
**Architect:** Redshift Architecture & Art  
**Engineer:** Central Engineering  
**Precast manufacturer:** Ultrafloor (aust)

### Design considerations

Redshift Architecture & Art developed a strategy whereby the majority of window and door openings were consolidated around generous recessed balconies. Redshift Director Angelo Korsanos says: "A diverse range of window sizes are consolidated around these balconies and other recesses to create an urban scale for the building. This strategy emphasises the surface of the building which was designed with broad areas of textured 'Reckli' panels interwoven with plain and boldly coloured flat-faced panels. The urban scale of the building is reinforced by the structured pattern of deep recesses, with textured and vibrant coloured panels which are animated by the movement of the sun and the pattern of light and shade."





## New Guide for Off Form Precast Surface Finishes

Certain benchmarks are required to produce a quality precast product for its appropriate application. The new Australian Standard AS3610.1 – 2010, Formwork for Concrete describes these benchmarks for off form concrete.

The full review of AS3610 has not yet been completed and it was decided to issue the Standard in two parts:

- (a) AS3610.1 Formwork for concrete, Part 1: Documentation and surface finish which focuses on surface finish and covers various types of documentation applicable to formwork; and
- (b) Part 2, which when published, will cover aspects of design and testing.

Prior to the publication of Part 2, AS 3610 and AS3610.1 will coexist. Sections 2, 3, 4 and 5 in Part 1 supersede Sections 2, 3 and 5, as well as Clause 4.7 of AS3610-1995.

In the new Standard, Surface Finish and Colour Control are now sensibly incorporated into Section 3 with Section 5 covering Evaluation of Completed Work and Repairs.

### Section 3

In terms of applicability, this section now makes it abundantly clear that the Standard applies only to off form surfaces. It does not apply to any surface treated with a secondary finishing operation (using chemical or mechanical means) such as polished, honed, grit (sand) blasted, acid etched and other such architectural finishes.

Table 3.2.1 defines in detail the characteristics of the surface classes with Class 1 being the highest standard and Class 5 the lowest. The table has been revised to show clearly where each surface class should be specified. Often, Class 1 has been wrongly specified for a project as the Standard states that **Class 1**:-

- Is the highest standard with the most rigorous specification and is only recommended for use in very special features of buildings of a monumental nature;
- Is suitable for selected small elements or areas of special importance in limited quantities; and
- Should be for elements contained in a single pour (this implies that different pours will differ in appearance from one another).

**Class 2** is that which will be specified for most good quality architectural precast concrete.

**Class 3** has application for buildings and structure where visual is important but which is of less importance architecturally. It provides an acceptable standard for many industrial and civil structures and will result in cost savings for the owner.



Class 2 finish - John Curtin School of Medical Research at ANU.

**Classes 4 and 5** are for situations where the visual quality is not important and apply to surfaces which are concealed from general view or are never seen.

### Section 5

This section covers the evaluation of any completed works, with Section 5.3 dealing with the physical quality of precast concrete. Colour evaluation is important and the standard has photographic charts for the assessment of colour by the use of tones.

The following Commentary has been added to Part 1 of the Standard to clarify the intent of tonal ranges –

“The tonal range illustrated in Fig A4, Appendix A, is not intended to represent the actual colour of the concrete but to indicate a range in the tones of the colour specified in Table 3.5.3. Hence Class 1 concrete may have a colour towards the dark end of the range in Figure A4, provided the tonal range is not less than 4 tones. For the specified Class, the project documentation may permit a greater tonal range than the minimum number of tones shown in Table 3.5.3.”

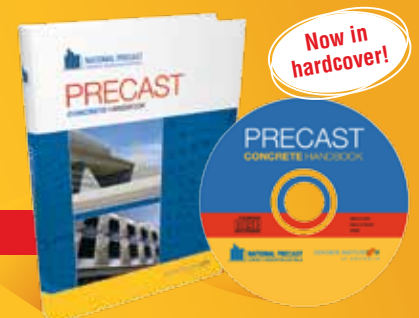
The Standard also states in section 3.4.3 that “For concrete of other colours or where the grey is not within the range of Figure A4, Appendix A, the project documentation shall contain a means of determining and recording the acceptable tonal range.”

The consideration of test panels as outlined in section 3.5 is critical when colour control is being considered or when Class 1 or 2 surface finish is specified. The often mistaken view that off form concrete will have a uniformity of colour, similar to paint, must be removed from the designer's mind when specifying off form precast concrete.

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# Bypass surgery

**\$331 million and 13,250 tonnes of concrete were just two of the ingredients required to build a new freeway to carry some 70,000 cars a day through Melbourne's outer west.**

The 9.3km Deer Park Bypass was a major project funded by VicRoads and the Commonwealth Government, connecting the Western Ring Road in Melbourne's Sunshine West to the Western Highway in Caroline Springs.

As well as four lanes of standard road, the project, overseen by Leighton Holdings, called for freeway interchanges, both a rail and a road overpass, an underpass, noise walls and a new shared-use path for pedestrians and cyclists. And, in keeping with Melbourne's reputation as Australia's style capital, aesthetics were important, too.

Located on volcanic grassland plains and punctuated by industrial estates, grazing land and expanding suburbs, the design integrated built form and colour into the landscape, using large scale, sculptured barriers and other strong elements to create a striking visual identity.

The initial precast elements of the project called for the supply of 128 prestressed precast T-Roff bridge beams for the bridge structures.

After a lengthy selection process, the contract for their supply went to Westkon Precast, which was also able to fulfil other project requirements, supplying over 100 very heavily reinforced (N-Bar) wing wall and fender wall panels, close to 1000 parapets, on- and off-structure barriers and half-barriers.

Production of the 128 prestressed precast concrete beams, weighing between 30 and 100 tonnes each, began in November 2007 and was completed by September 2008. During the same period another 349 prestressed precast concrete beams for another Leighton Holdings project were also being cast.

Stressing beds capable of holding 1500 tonnes each were used to manufacture the beams – some up to 1800mm deep and weighing 96 tonnes.

The moulds were enclosed with automatic temperature controlled hot and chilled water pipes, to ensure high early strength enable demoulding the following day.

The beams were removed from the moulds using portal cranes, which also offered storage space for over 100 of these massive beams.

Testimony to the smooth running of the project was the fact that it was completed eight months ahead of schedule, with all parties – including many Victorian motorists – pronouncing themselves more than happy with the results.

## Deer Park Bypass

**Client:** VicRoads & the Commonwealth Government

**Chief contractor:** Leighton Holdings for VicRoads

**Architect:** Peter Elliott Architect + Urban Design  
**Landscape Architect:** Steve Wallbrink & Associates

**Engineer:** GHD

**Precast manufacturer:** Westkon Precast

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