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Melbourne Recital Centre shows GRC advantage

A recent addition to Melbourne's famed Southbank cultural precinct, the Melbourne Recital Centre (MRC) has already become a city landmark. And it owes both its distinctive form and highly specialised function to the unique qualities and flexible applications of Glass Reinforced Concrete (GRC).

For MRC architects Ashton Raggatt McDougall (ARM), the project brief posed a number of challenges. First, to create a building with an identity all of its own that was still also a member of the 'family' of other cultural buildings situated in Melbourne's Southbank precinct, notably the National Gallery of Victoria and the Melbourne Theatre Company.

Second, to do so in a cost-effective and environmentally sustainable fashion.

And third, to ensure that the design and construction techniques and materials delivered maximum acoustic performance – a particular challenge given that the building is a musical performance space located between a tramline and one of Melbourne's major traffic thoroughfares.

GRC: a three-way solution

One of the standout construction materials of choice for ARM, meeting all the requirements of the brief, was GRC. Easy to mould into even complex and highly textured forms, it offered exciting aesthetic possibilities. Lightweight – at a slender 25mm its panels can be cast thinner than those of conventional precast – and strong, it was both a cost effective and environmentally sustainable choice. It also has excellent acoustic properties, blocking both street noise and enhancing the quality of the performance space within.

The look the architect was seeking was akin to the polystyrene insulation used in packaging, highlighting that the building is like a 'gift', comprising layers to be unwrapped.

Innovation for strength and beauty

Following the decision to use a blend of glass, bluestone blockwork and GRC for the façade, Adelaide-based GRC specialist Asurco Contracting was selected to supply and manufacture the highly distinctive customised GRC panels required.

"This was an extremely complex job," says Asurco Managing Director, Des Pawelski. "The pattern had to be clear and defined, all the individual pieces had to interlink, almost every panel was different and, because the pattern had to match up exactly, there was no margin for error."

Creating the details of the desired bubble-effect surface in the GRC panels required use

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President's Column

National Precast has a busy programme set for 2010. Officially declared in February 2008, the *National Code of Practice for Precast, Tilt-up and Concrete Elements in Building Construction* is now being progressively adopted in all State jurisdictions.

To help the industry understand the requirements of the new Code, National Precast is running two new half-day workshops in Adelaide, Perth, Melbourne, Hobart, Brisbane and Sydney through May and June of 2010. 'Precast + Safety: Designing for Safety Using the National Code', has been developed for engineers, builders and precast manufacturers, whilst 'Precast + Safety: Erecting with Safety Using the National Code' is for builders, erectors and precast manufacturers. Also on the education front and in addition to these workshops, National Precast will continue to run its successful one-day seminars 'Introduction to Precast for Structural Engineers' for less experienced engineers and engineers who wish to build their skills about precast concrete.

On top of the busy education programme, National Precast will also continue on with its other activities, including continuing to sell the new (Edition 2) Precast Concrete Handbook and other publications; developing new Standard Walling and Flooring Detailing Manuals and a new Recommended Practice for the Design, Manufacture and Installation of Sandwich Panels; producing its quarterly National Precaster publication; participating on several Australian Standards Committees; and exhibiting at the major national construction industry exhibitions, Form & Function and Designbuild.

Peter Healy – President

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of specialised moulds. These were created by stapling a polyurethane moulding onto melamine-coated particleboard, which was in turn placed inside each steel mould. When the mould was removed, the moulding stripped away cleanly, revealing the pattern.

For structural strength, each panel had steel framework fixed into the rear, which acted as a connection medium for fixing the panels to the building structure.

The panel design also featured an overlap edge to hide joins between panels. White cement, with no added colour, was used.

The result?

A highly distinctive building that aesthetically 'speaks' to its famous precinct 'cousins'; that has been cost and environmentally effective and that delivers the high quality acoustic performance required.

Light, strong and flexible: it's GRC

GRC is a composite material comprising a cement base interspersed with glass fibres that add flexural, tensile and impact strength. It is used to make strong, lightweight architectural products. Developed 50 years ago by the UK Building Research Institute and Pilkington Glass, it is used for a vast variety of structural and aesthetic purposes.

Melbourne Recital Centre

Location: Southbank, Melbourne
Project manager: Major Projects Victoria
Architect: Ashton Raggatt McDougall
Acoustic consultant: Arup Acoustics
Builder: Bovis Lend Lease
Specialist Concrete Contractor: Asurco Contracting

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UTAS Co-Location Project Menzies Building

The new 5-storey Menzies School of Medical Research in Hobart is an iconic building that is certainly the most distinctive in Tasmania – achieved by its use of a striking precast façade.

Head Contractors, John Holland and Fairbrother, worked collaboratively with the designers Lyons Architects and the precast manufacturer (The Precasters) in realising their vision for this iconic building façade.

The façade incorporates coloured precast concrete panels with feature architectural shaped motifs, integrally cast steel window frames and purpose manufactured double glazed window units. There are prominent "arches" in the precast panels at the entrances at ground level and at the high window openings on the floors above. The arches were designed to reflect the profile of the surrounding mountains and hills that cradle Hobart.

The combinations of curves, textures, recesses, and colours serve to dramatically change the appearance of the building in different light conditions.

Corners of the building also feature concave and convex curved panels with two different radii that allow the building to follow its unusual platform that is shaped to fit around the Heritage Listed Hollydene House. The curved corners help to integrate the multiple facades.

The 212 architectural precast façade panels feature exposed limestone aggregate inset with areas of integrally coloured off-form free-form inset motifs. The motifs were cut from 30mm plywood using a CNC router, with the cutting programmes derived from the architects CAD drawings of the façade. Local limestone was sourced for the exposed aggregate work. A special aggregate mix design was developed to maximize the amount of stone appearing on the surface. Silica fume was needed to overcome an alkali-aggregate reaction problem with the chosen limestone aggregate. The exposed surface was achieved with face-down casting onto surface retarders painted onto the casting bed, followed by water-blasting the following day.

The precast façade panels are generally non-loadbearing, with open drained vertical joints externally. Façade panels are typically 230mm thick, 4.25 metres tall and 6.6 metres long, but this varies greatly. Panel weights are up to 18 tonnes.

Matching internal foyer precast panels are used to draw the arch effect into the building envelope. 120 precast columns, 57 precast liftshaft panels, 35 foyer feature panels, and 44 roof plant room panels all add to the speed of construction and a high quality of maintenance free finish.

UTAS Co-Location Project Menzies Building

Location: Liverpool & Campbell Streets, Hobart
Client: University of Tasmania
Architect: Lyons
Engineer: Bonacci Group
Head Contractor: John Holland – Fairbrother Joint Venture
Precaster: The Precasters
Precast Installer: JMK Constructions

Sandwich panels offer BCA compliant walling solution

Interest in precast concrete sandwich panels has increased over the last few years with the onset of tighter Government controls over the effective use of energy and resultant increased R-value requirements within the Building Code of Australia. Sandwich panels offer reductions in energy usage for both heating and cooling and when combined with other energy saving elements such as double glazed windows may eliminate the need for air-conditioning or heating all-together in some climates.

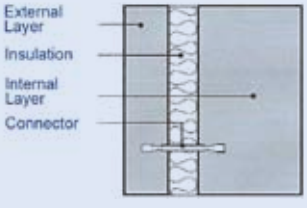
Precast concrete sandwich panels are similar in appearance to solid precast panels with the distinct difference being their thermal insulating properties which make them ideal for air-conditioned spaces and residential dwellings. Another property of sandwich panels is the thermal mass created on the interior of the building (thermal storage capacity), capable of storing and releasing heat to minimise fluctuations in the internal temperatures of the building. Sandwich panels also insulate against noise transmission of both airborne and impact sound. In addition they are fire resistant and incredibly durable.

Sandwich panels can be used for both external and internal walls and do not require internal lining. They can be used as cladding or as a structural element to the building and can have a variety of architectural finishes.

What are sandwich panels?

Sandwich panels are comprised of three layers - an outer thinner skin of non-structural reinforced precast concrete, an insulation layer of polystyrene foam and an internal layer of structural reinforced precast concrete (which creates the thermal mass). The three layers are held together by non-conductive connectors (or ties). These connectors allow the layers to move independently of each other, allowing for thermal expansion and contraction without affecting the structural integrity of the element.

Typical Wall Section



The External Layer

The external layer of reinforced precast concrete is typically around 50-70mm thick and 35Mpa (depending on external requirements) and protects against the external environment.

The Insulation Layer

The rigid insulation layer is usually around 75mm, however thicknesses between 30mm to 100mm and greater can be used, depending on insulation requirements and project location. The insulation protects the interior of the building from external temperature variations. The insulation layer is typically either (EPS) Expanded Polystyrene or (XPS) Extruded Polystyrene, which have differing insulation properties.

The Internal Layer

The internal layer of reinforced precast concrete is typically 100–150mm thick and 35Mpa (depending on the structural requirements of the engineer) and is the structural layer of the sandwich panel.

The Benefits

Due to the unique manufacturing process precast concrete sandwich panels offer many benefits to the designer, the builder and most importantly the end user. They are an economical, strong, durable, versatile, energy efficient and fire resistant walling solution.

Energy Efficient

Precast concrete sandwich panels have superior insulating properties with flexibility in design to allow for varying R-value requirements. Depending on the required R-values, the insulation material and thickness can be varied. The excellent thermal mass of the inner concrete layer is unmatched by any other material. The insulation is installed in a controlled factory environment and is protected by the concrete layers both externally and internally.

Economical

Precast concrete sandwich panels are produced in factories under controlled conditions. They are used as the entire wall structure (internal and external) and the high quality finish requires nothing other than perhaps staining or painting. There is no need to line the inside as the thermal mass properties are most effective if the interior walls of the panels are NOT lined and are left as a painted or stained only, bare concrete finish. Externally, minimal maintenance means ongoing savings over the entire long life of the building.

Fire Resistant

With concrete both externally and internally, sandwich panels are inherently fire resistant.

Durable

Sandwich panels are produced using a minimum concrete strength of 35Mpa and can last up to 100 years. The rigid insulation layer remains intact over time, protected by the concrete layers.

Versatile

Designers of sandwich panels are fortunate to have the flexibility of custom manufacture for size, shape, finish and colour. Exterior finishes can be smooth, textured or patterned. Textures can be achieved by acid washing, grit blasting, honing or polishing. Alternatively form liners can be used in conjunction with staining to achieve outcomes which are limited only by imagination and budget. Painting is also an option. The smooth prefinished reinforced concrete of the interior wall provides a surface resistant to everyday wear and tear damage.

Instant building

When precast concrete sandwich panels are erected in the final position you have both the external and the internal wall finished… ready for the roof, doors and windows to complete the structure. Precast concrete sandwich panels can be used for both wall cladding (attached to a structure) or as a loading bearing structural element. They are similar to normal precast concrete panels for erection purposes and are therefore easily erected by an experienced precast panel erection crew.

When energy efficiency, fire safety, insulation, durability and appearance are important, precast concrete sandwich panels are the solution of choice.

For more information about sandwich panels refer to chapter 2.2.2.4 of the second edition of the *Precast Concrete Handbook*. For a typical sandwich panel R-value calculation refer to chapter 9.1.8. To purchase the *Precast Concrete Handbook* go to www.nationalprecast.com.au

Strong enough for elephants

The male Elephant Enclosure at Taronga Zoo is part of the new $40M elephant exhibit which has been built to house an additional five elephants imported from Thailand.

The attractive but supremely strong precast concrete enclosure is the home to one male 'Bull' elephant and rotating visits for breeding purposes from the herd of 'Cow' elephants. The panels have to be able to withstand huge point of impact loads from potentially aggressive and dangerous elephants. Precast concrete is the obvious choice for this task.

The enclosure is formed from 47 large precast panels made from neutral coloured concrete. A total of 60 precast units are incorporated, comprising wall panels, gate panels and a planter box.

The biggest panels are nine metres high, three metres wide and weighing a significant 17 tonnes. With only four base moulds used, the design has cleverly created a pattern where every panel seems unique. The main feature of the precast façade is the unique pattern cast into the external face of the panels. The purpose of the pattern is to transform a building which is essentially a large concrete box into a structure that will be viewed as a background building strong in its own right with detail references to natural shapes and forms, while contrasting with the Heritage Elephant Temple and its golden dome. Importantly there was a dialogue between the design requirement to limit any repetition around the building and the precaster's desire to maintain mould efficiency by limiting the number of moulds required – the end result cleverly achieves both aims.

The solution is a mix of aesthetic treatments that were conceptualised by the designers and developed by the precaster's in house design team throughout the shop drawing process. Close collaboration between the client, the architects Jackson Teece, the builder ADCO, and Precast Concrete Products, was the key to the success of the finished façade.

The façade solution includes the following aspects:

- The panels are inclined at five degrees from the vertical to soften the shape of the overall building.
- Panel to panel joints are inclined at five degrees from the vertical to help the joints blend into the pattern and help hide the regularity of the panel sizes.
- The top edge of the panels are staggered to further break any appearance of regularity.
- The fine pattern which represents foliage is randomly distributed around the façade. A series of mould liner shapes were created at the precaster's in-house mould workshop for this purpose.
- The deeper pattern comprises varying width grooves that add another layer of complexity to the overall appearance and allow a more unique look to each individual elevation. Great care was taken to ensure that these deeper grooves were seamless across panel joints.
- Panels are integrally coloured with oxides after an extensive sample and approval process.

The precast panels are nominally 300mm thick and tapered to almost 400mm at the base of the panels to stiffen the connection to the base structure. The panels are heavily reinforced and fixings stiffened to resist the forces that could be applied by the inhabitants throughout the life of the building.

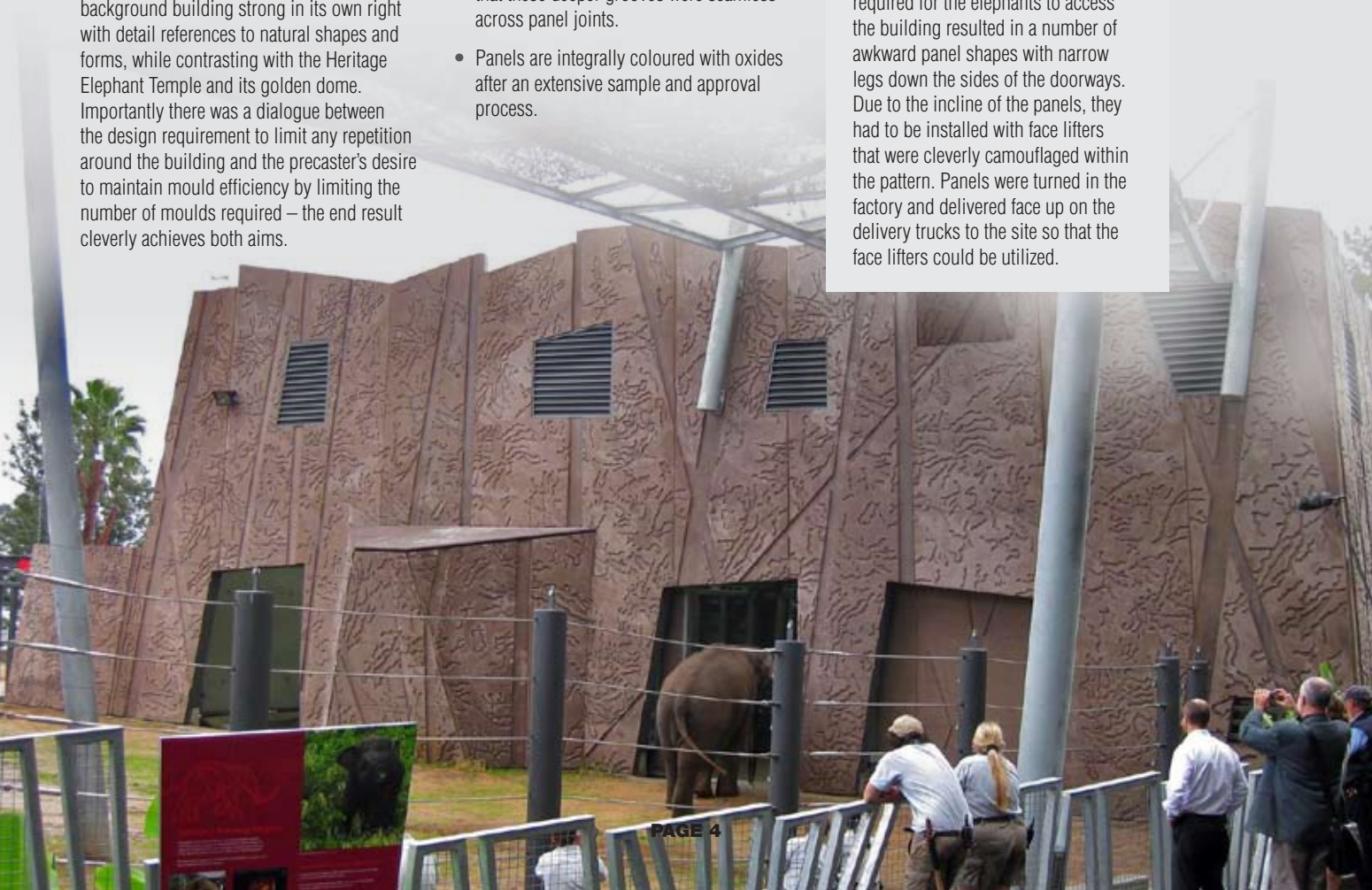
The result is a building that, when viewed from the Harbour or up close, blends in with the surrounding vegetation and pays respect to the Heritage Elephant Temple.

Taronga Zoo Male Elephant Enclosure

Client: Taronga Conservation Society Australia
Builder: ADCO
Architect: Jackson Teece
Engineer: Hughes Trueman
Precast Manufacturer: Precast Concrete Products

A manufacturing challenge

These features presented the precaster with a unique series of challenges throughout manufacture. Due to the slope of the panels and the joints, the mould geometry was complicated as no corners were square and no mould sides were normal to the casting beds. Each panel was unique so the mould pattern had to be modified for every cast. The large doorways required for the elephants to access the building resulted in a number of awkward panel shapes with narrow legs down the sides of the doorways. Due to the incline of the panels, they had to be installed with face lifters that were cleverly camouflaged within the pattern. Panels were turned in the factory and delivered face up on the delivery trucks to the site so that the face lifters could be utilized.



6-star Precast in NSW

Workplace 6 is situated on the waterfront at Pyrmont, next door to the Sydney Casino. The highest achievable Green Star rating is proudly advertised by tenants such as Google who have chosen the building for their new Sydney headquarters.

Construction commenced in April 2007 and was completed in November 2008, providing approximately 18,200 sqm of space over six storeys and offering some of the largest commercial floor plates in Sydney, of over 3,600 sqare metres. All office levels enjoy excellent natural light and exceptional harbour views to the north and east of the Sydney Harbour Bridge and the western CBD skyline.

Michael Morgan, Managing Director of nettletontribe architects offers an insight to the design philosophy of the precast façade by commenting, "Responding to the sandstone escarpments along Pyrmont Point and the casino building to the south, the Pirrama Road façade is predominantly masonry in the form of precast concrete panels."

"The facade has been designed to complement the adjacent street facade of the casino building, with building services access contained within this masonry street frontage."

The use of replacement cementitious materials and recycled aggregates in the precast façade contributed to the achievement of this momentous 6-star goal. The challenge for Brisbane based Precast Concrete Products was to comply with the stringent environmental criteria at the same time as delivering a high quality acid washed, integrally coloured finish on the panels.

The biggest issue for the precaster was in relation to the recycled aggregates required to achieve the Green Star rating. Commercially available sources of recycled aggregates are typically contaminated with wood, glass, bricks and other materials, so an innovative manufacture technique was developed to allow this material to be used in the concrete mix whilst still maintaining high strength and durability requirements, along with the high quality of finish required on the faces of the panels.

The resulting façade satisfies both the high quality aesthetic requirements and the stringent environmental criteria and showcases the ability of precast to provide both form and function in contemporary building projects.

Workplace 6

Owner: The GPT Group
Developer: Citta Property Group
Builder: Buildcorp
Architect: nettletontribe architects
Engineer: TLB
Precast Manufacturer: Precast Concrete Products

SA Water on the Move – with a 6 Green Star Building

In 2002 SA Water developed a long term accommodation strategy to meet changing business requirements and bring together its three metropolitan sites. Various options were considered and the one that delivered the best overall value was to consolidate the three sites into one central location in the heart of the Adelaide CBD. High on the list of priorities was that the new office building be an exemplar of sustainability.

After a public tender in 2004 the Catholic Archdiocese of Adelaide won the right to develop the 35,350m2 gross floor area, 10-storey, $100M office building for SA Water in Victoria Square, and construction began in 2006. Now complete, SA Water House is the first building in South Australia to be awarded a 6-star Green Star office rating from the Green Building Council of Australia – the largest commercially developed building in Australia to receive such a rating.

Among the many features that have delivered this outstanding result is the contribution of precast concrete in a range of locations throughout the building. Precast minimises the generation of waste and multiple handling, while the concrete mix in the panels uses recycled flyash (the waste ash from the burning of coal in power stations) to reduce the requirements for cement, resulting in the consequent reduction of greenhouse gases compared to the production of conventional concrete. Up to 20% of the cement was substituted by flyash, helping to contribute to the 6-star rating.

Bianco Precast manufactured 108 precast stair panels, generally 4-metres by 3.2-metres, being 250mm and 275mm thick. Some stair panels were supplied with interesting architectural dimple features all in grey off-form. Architectural dimple features were also used in panels for the north wall, where off-white cement achieved the lighter colour which was desired by the architects. Additionally 13 off-white acid etched raking columns were also manufactured, being 500mm square by 10-metres long.

Not so unusual anymore, there were two precast manufacturers working on the one project.

In this case, Hicrete Precast supplied the large off-form grey precast cladding panels to the basement. Hicrete's panels were a mix of 11 load bearing 175mm thick panels and 36 non-load bearing 130mm thick panels. All were simply butt jointed. The concrete strength on delivery to site was 45 MPa to provide immediate structural capability requirements and a high degree of durability.

It can sometimes be overlooked that the outstanding durability of precast concrete is a major attribute in the true environmental performance of a building over the long term. Certainly, the SA Water building stands to be around for a long term.

SA Water House

Location: Cnr Angus Street & King William Street, Adelaide
Client: Catholic Church Endowment Authority
Builder: Hanson Yuncken
Architect: Hassell
Engineer: Walbridge & Gilbert
Precast Manufacturers: Bianco Precast and Hicrete Precast

New Precast Workshops/Seminars in 2010

Precast+Safety: DESIGNING FOR SAFETY Using the National Code

Presented by Peter Webb, Marketing & Education Manager from National Precast and Pauline Butler, Butlers Training Services

City	Date	City	Date
Adelaide	Wednesday 5th May 2010	**Hobart**	Wednesday 12th May 2010
Perth	Wednesday 19th May 2010	**Brisbane**	Wednesday 2nd June 2010
Melbourne	Wednesday 9th June 2010	**Sydney**	Wednesday 16th June 2010

Half day awareness (9am – 12.30pm) workshop for engineers, builders and precast manufacturers about the National Code of Practice for Precast, Tilt-up and Concrete Elements in Building Construction

Cost: National Precast Members $120 | EA, MBA, CIA, AIB, NBPR & CoB Members $170 | Others $230

Note: EA and AIB Members can choose to record CPD hours for attendance at this event in their personal CPD logs.

To register go to **www.nationalprecast.com.au.** NEW!

Precast + Safety: ERECTING WITH SAFETY Using the National Code

Presented by Peter Webb, Marketing & Education Manager from National Precast and Pauline Butler, Butlers Training Services

City	Date	City	Date
Adelaide	Wednesday 5th May 2010	**Hobart**	Wednesday 12th May 2010
Perth	Wednesday 19th May 2010	**Brisbane**	Wednesday 2nd June 2010
Melbourne	Wednesday 9th June 2010	**Sydney**	Wednesday 16th June 2010

Half day awareness (1.15 – 4.45pm) workshop for builders, erectors and precast manufacturers about the National Code of Practice for Precast, Tilt-up and Concrete Elements in Building Construction

Cost: National Precast Members $120 | MBA, CICA, AIB, NBPR & CoB Members $170 | Others $230

Note: AIB Members can choose to record CPD hours for attendance at this event in their personal CPD logs.

To register go to: **www.nationalprecast.com.au** NEW!

Introduction to Precast for Structural Engineers Seminar

Presented by Nicholas Mills, BEng (Hons), PhD, Structural Engineer with Kellogg Brown and Root P/L, local engineers and National Precast Members

City	Date	City	Date
Adelaide	Tuesday 16th February 2010	**Sydney**	Wednesday 24th March 2010
Melbourne	Friday 25th June 2010	**Brisbane**	Friday 20th August 2010
Perth	Wednesday 20th October 2010	**Hobart**	Tuesday 7th December 2010

This is a **full day technical seminar** (9am – 4.45pm) aimed at teaching less experienced engineers and those who want to build their skills about precast concrete. Attendees receive a full copy of the notes, a CD of the 2nd edition (2009) Precast Concrete Handbook (valued at over $180) and an additional CD which includes a range of data on precast (including a draft precast specification in Natspec and up-to-date drawing notes).

TOPICS INCLUDE: Materials & Tolerances, Precast Building Design, Manufacture, Transportation & Erection, Design of Elements, Contractual & Design Responsibilities, Connections, Fixings & Joints and Thermal, Acoustic, Fire properties and Architectural aspects.

Cost: National Precast, Concrete Institute & Engineers Australia Members $350 | Others $475

Note: Engineers Australia Members can choose to record CPD hours for attendance at this event in their personal CPD logs.

To register go to: **www.nationalprecast.com.au**

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