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NATIONAL PRECASTER

NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA

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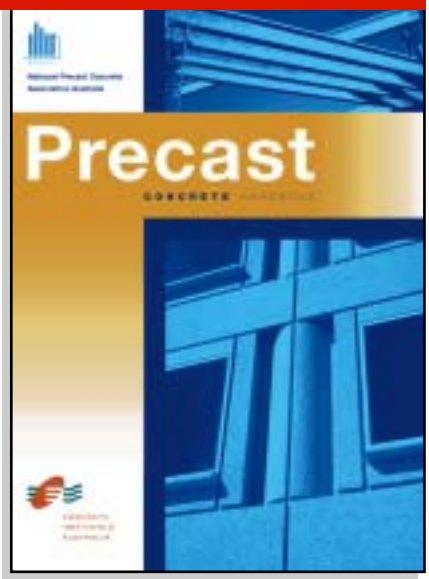
ANNOUNCING the NEW 'Precast Concrete Handbook'

Published by the National Precast Concrete Association Australia and the Concrete Institute of Australia, the *Precast Concrete Handbook* has been four years in the making.

A distinguished team of authors including consulting engineers, academics, members of the National Precast Concrete Association Australia, the Concrete Institute of Australia and the Cement and Concrete Association of Australia have all assisted in its preparation.

It is the definitive and authoritative text on the design, manufacture and erection of precast concrete in Australia and should be in the library of every architect, engineer and specifier who works with concrete in Australia.



NPCAA'S PRESIDENT, CLAUDE PINCIN SAYS THIS ABOUT THE Precast Concrete Handbook:

"Compared to other countries, precast concrete is an under-utilised form of construction in Australia. One of the reasons for this is the unfamiliarity and lack of understanding that designers have with the medium. As noted architect C J Crosling expressed in *Architectural Bulletin* Feb/Mar 2002…'Precast concrete is a neat, versatile material offering an array of aesthetic possibilities and structural solutions that in the current design climate are essentially ignored'. This Handbook goes a long way to overcome the mystique and misconceptions of precast concrete construction. It encapsulates the experience of the local precast industry and makes it available to designers. It draws their attention to important design considerations and providing a series of typical details for connections and the like.

The successful use of precast concrete depends on the collaboration of the architect, engineer, precast manufacturer, erector and the main contractor. In recognising these relationships, the Handbook is much more than a design manual; it provides specification guidance to the various parties suggesting how the responsibilities of each may be allocated to avoid conflict and ensure the full benefits of precast are realised."

Moreover, **JOHN WOODSIDE**, *BE(Civil), MEngSci, FIEAust, FASCE, MICE, MIStrucE,* a leading practitioner in Australian precast design, Principal of J Woodside Consulting, South Australia and formerly Principal of Connell Wagner, South Australia, enthusiastically endorses this much-awaited publication:

"While precast concrete in Australia dates from 1904, since World War II, precast concrete has played a significant part in the improvement in construction productivity, in the quality of projects and in the production of architectural shapes and finishes impossible to achieve with insitu methods."

"The evidence of the pre-eminence of precast concrete in Australia includes projects such the Sydney Opera House, Parliament House in Canberra, the Sydney Olympic Stadium, major bridges such as the Narrows Bridge in Perth and many high-rise buildings. These are all testament to the huge contribution that precast concrete has made and is continuing to make to Australian building and infrastructure construction."

John says, "The authors of the book have collectively over 300 years of concrete and precast experience between them. The Handbook reflects current industry best practice featuring the latest innovative applications of precast concrete. These range from simple structural elements to industrial and skeletal frame buildings, to decoratively finished complex-shaped architectural facade panels and sophisticated bridge girders. The Handbook also reflects the collective experience of the wide range of authors in distilling the years of experience into simple and easily understood principles."

"Precast concrete in Australia in the future will become an even more important construction product than it is now. This is because of the continuing shortages of skilled labour, and the need to reduce dirty, difficult and dangerous site tasks. Customers and end users are demanding better, more efficient and sustainable projects of higher quality."

The *Precast Concrete Handbook* is intended for architects, engineers, designers, construction staff, quantity surveyors and undergraduates as well and all those involved in the building, infrastructure and construction industry. It features twelve chapters and an appendix which provide comprehensive information as follows:

History and Applications covers a brief history of precast concrete in Australia as well as typical applications in building and civil engineering infrastructure.

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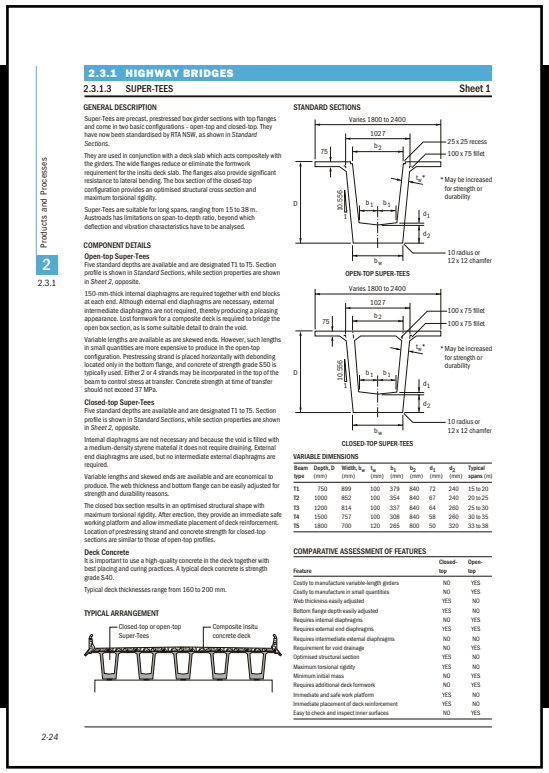

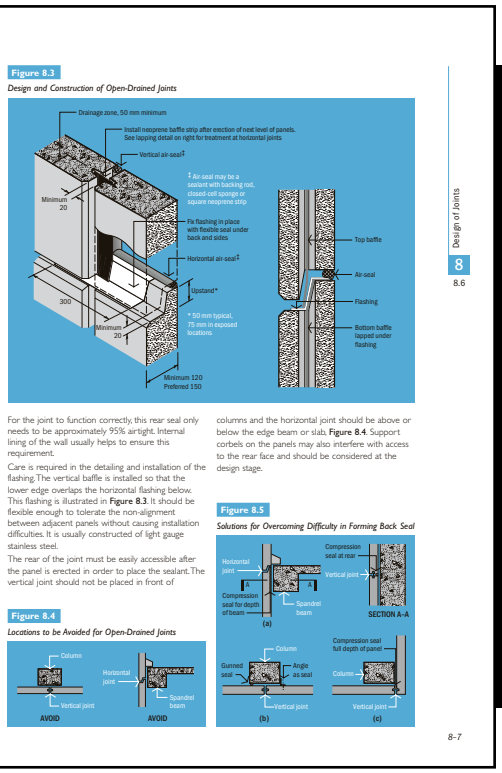

Products and Processes covers technical data on generic products that have become standard units as well as featuring aspects of precast manufacture.

Materials and Material Properties provides an appreciation and understanding of materials and their properties commonly used in the manufacture of precast reinforced and prestressed concrete.

Tolerances details fabrication, manufacturing and building tolerances to be considered during layout and design of structures.

Analysis and Design of Buildings provides guidelines and worked examples for the analysis and design of buildings wholly or partly constructed of precast elements.

Design of Elements covers the basic principles relating to the static and dynamic design of precast elements and provides examples showing design procedures that address flexure, shear and torsion.

Connections and Fixings provides guidelines for the design of connections and fixings used to attach precast elements to each other and the main structure including design examples for typical connections.

Design of Joints provides a description of various joint designs, their advantages and disadvantages, and a selection guide for types of sealants including fire resistant compounds.

Thermal and Acoustic Properties provides information to designers on thermal and acoustic performance of common precast walling and flooring systems.

Architectural Elements demystifies the subject of architectural precast concrete including procedures for selecting surface finishes and how to specify and administer colour control and other important architectural criteria.

Handling, Transport and Erection provides guidelines and procedures for safe handling, transportation and installation of precast building components.

Contract Issues provides commercial guidance to ensure the successful and expeditious completion of precast concrete contracts with special attention given to allocation of design responsibility, and explanation of risk allocation and specification issues.

General Design Information The Appendix provides general engineering information to facilitate designing in precast concrete. Dead loads, live loads, moment diagrams, material properties, properties of geometric sections and metric conversion tables are included. ■

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Welshpool Road Bridge on Roe Highway Extension, with main span composed of 6 No. Tee Roff Beams 30 m length, each weighing 85 tonnes.

BRIDGING the Gap in Western Australia

ROE HIGHWAY EXTENSIONS Stages 4 and 5

A new bridge construction system chosen by engineers Gutteridge Haskins and Davey and contractors Leightons is now being manufactured in Western Australia. This system is advancing the efficiency and speed of bridge construction in the State while minimising disruption to traffic.

Delta Corporation Ltd, the leading precast concrete specialist in Western Australia, introduced the standard Austroads Super Tee Beams or more commonly referred to as Tee Roff Beams, into Western Australia in early 2001. They were first introduced for the Northam Bypass Project, approximately 75 km east of Perth on the Great Eastern Highway. The project involved 53 beams 1.2 m deep x 2.4 m wide, ranging from 13.2 m to 27.4 m in length weighing up to 38.5 tonnes. A total of six bridges were involved consisting of one to four spans each.

In July 2001 the precaster was invited by Leighton Contractors to manufacture Tee Roff Beams for five bridges on the Roe Highway Extensions Stages 4 & 5, which is being carried out along an 8 km alignment. The bridgework involves 88 beams 1.5 m deep x up to 4.2 m wide ranging from 14 m to 30 m in length on the Welshpool Road, Spencer Road, Nicholson Road and Brixton Street bridges. The beams weigh between 42.5 tonnes to 82.0 tonnes each.

The Canning River Bridge requires larger beams with the main span beam being 2.25 m deep x 42.0 m long x 4.4 m wide weighing 150 tonnes. The end spans are only 16.0 m, however the beams taper from 1.10 m to 2.25 m in depth.

In order to cater for the range of beam sizes the manufacturer elected to design an adjustable steel mould. The height can also be adjusted but at considerable expense and needs to be pre-planned. The mould is also fitted with high frequency external vibrators, which ensure a high degree of concrete compaction and quality of finish.

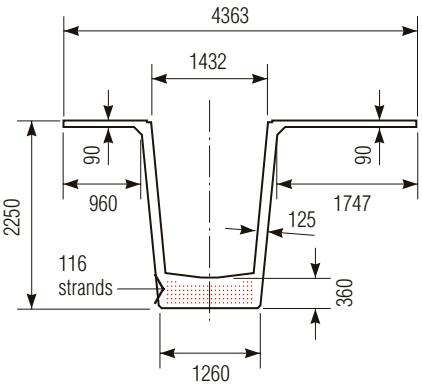
With the assistance of NPCAA Associate Member Sika Australia Pty Limited, the manufacturer has had no difficulty in achieving the required overnight transfer strength of 40 MPa. This has been achieved by using a traditional steam-curing system and a unique non-chloride high-early strength admixture Sikament® HE 200NN. The beams are removed from the mould, stored and loaded onto heavy-duty steerable jinker for transportation to site, using portal cranes. Either one or two large capacity mobile cranes carry out installation on site.

Unlike the standard beam Austroads have adopted in the eastern States, Main Roads WA have developed a criteria of height to width ratio for supporting piers which effectively makes the cross-section of each Tee Roff Beam on each bridge different.

Tee Roff Beams are specially made to provide single precast concrete spans, which can be delivered and installed as required. Off-site production is far superior to on-site production, ensuring quality control, accurate specifications, while lead-times are also reduced.

To enable the manufacture of these beams, the company has installed what is believed to be the largest capacity prestressing bed in Australia, allowing it to manufacture precast beams with prestress up to 2500 tonnes. General Manager, Matt Perrella,says the new Tee Roff Beam facility gives us even greater versatility in the production of commercial precast concrete. "We introduced the first standard mould to manufacture Tee Roff Beams for the Northam Bypass Project, but the Roe Highway Extensions involved even larger spans, so we decided to make the investment and install an additional, larger facility looking to the future," he said.

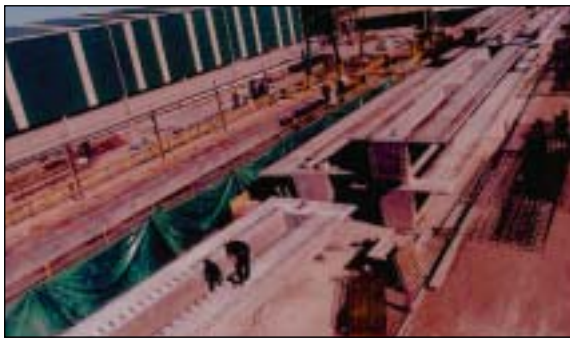
"Because of our large production capacity at Herne Hill, and the new adjustable mould, we can provide Tee Roff Beams of varying width and length, adding to our ability for producing precast concrete elements for small, medium and very large projects."



Cross-section of Tee-Roff Girders supplied for Canning River Bridge

The production of beams for the Roe Highway Project is scheduled for completion in September this year.

The company is also providing 16 000 square metres of prestressed concrete noise panels for erection either side of the Roe Highway plus 1000 posts to support the panels. The 2300 panels measure 6.0 m long x 1.2 m in width and 75 mm in thickness and designed to reflect noise from the highway. The noise wall panels have been developed through community consultation with local residents and are being produced approximately 20 panels a day. The panels receive an applied finish to the residential side of the fence before delivery and the applied finish for the highway side of the panels is carried out on site for Main Roads.



Aerial view of casting yard in Perth where bridge girders for Roe Highway Extension were manufactured

Spencer Road Bridge under construction; featuring three unique Y-shape columns supporting the 6-girder superstructure

Matt Perrella notes that, 'Working with active NPCAA Associates, such as Sika Australia, is important for us to stay on top of market advances which are an integral part in expanding the use of precast concrete. Tapping into the resources of companies such as Sika Australia does this, and gives us some other competitive advantages. A cooperative teaming of NPCAA Member resources has been a key reason for the success of this project.' ■

YARRA'S EDGE Residential Project

An artists view of Yarra's Edge high-rise, residential development in Melbourne's Docklands precinct. DEVELOPER: *Mirvac Group* CONSTRUCTION: *Mirvac Construction* ARCHITECT: *HPA* CONSULTING ENGINEER: *Scott, Wilson, Irvine & Johnston*

The Yarra's Edge high-rise, residential development is growing skywards at a rapid pace. The third of the buildings on the southern bank of the Yarra in Melbourne's Docklands Precinct is already under construction. A single, 31-floor tower sitting on four levels of above-ground parking, it will, when completed, provide the fourth tower of the Yarra's Edge project, buildings numbers one and two having a single and twin towers respectively. The developer decided on the use of a range of precast elements supplied by NPCAA Members, Hollow Core Concrete Pty Ltd and SA Precast Pty Ltd.

Hollow Core Concrete supplied hollowcore planks, columns, beams, ramps and precast stairways for the construction of the five level carpark for a number of reasons. These include the rapidity of construction, large spans between columns, access to trades through the absence of formwork, as well as economies inherently available through the use of hollow core planks. The combined floor area of the carpark is 6700 m^2 plus the ground floor which is a reinforced slab. The car park is divided into a grid with inner spans of 4.2 m and outer spans of 12.3 m. It took only three days to construct two sections of the second level with an approximate floor area of 850 m^2.

The use of hollow core planks provides ready made conduits for services and the manufacturer also provided a number of beams with conduits to facilitate the installation of electrical and mechanical services. This, combined with the absence of formwork, permits the builder to rapidly complete the first stage of building No.3. The precast stairways, two sets of 10 flights each, are installed and anchored on shelf angles, providing convenient access for construction workers. The hollow core planks forming the 12.3 m spans of the carpark are, at their far ends, anchored on corbels which are part of precast wall panels projecting above the plank level. A natural and economical safety roof enclosure is thus provided while reinforcing and screed are being placed on the planks.

There are considerable advantages to the use of hollow core planks in construction projects. The hollow cores lighten the plank without affecting its strength. The load spreading characteristics of hollow core planks are excellent. As an example, a plank, being a part of a 10-m-span plank-floor with screed topping, to which a point load is applied bears only 23% of that load. The two successive planks on either side bear respectively, 21% and 17.5% of the load.

The construction method is economical in terms of material and labour costs. Savings relative to on-site concrete pour construction vary depending on the building design and functionality required. As an estimate, though, savings can be 15% of on-site concrete pour costs.

Adelaide precaster, SA Precast provided a range of precast architectural elements which contributed to the aesthetic appeal of the building. Within the podium level, there are 78 polished reconstructed Black Hill (South Australia) granite panels ranging in size from 900 mm to 3500 mm in height and 15 sandblasted blade columns, up to 6m length. Between the sandblasted columns, there are a number of white polished L-shaped spandrel panels. The shape of these necessitated the internal faces to be hand polished, rather than conventional machine polishing.The spandrel mix comprised aggregates from Broken Hill and Harcourt, Brightonlite cement with a resulting 28-day strength of 55–60 Mpa. ■

(above) Sections A and B of the car park for Yarra's Edge building No.3. Note the large spans (12.3 m) of hollow core planks providing high efficiency in space utilisation

(below) Aerial view of Yarra's Edge building No.3 carpark in construction. A 31 level tower will rise above the five level above-ground carpark

PRECAST Partnering Delivers Results

Erection of hollowcore floor planks and Transfloors balcony units on top floor of the Beaconsfield apartments

GREEN SQUARE is the name given to the master plan for the transformation of the inner Sydney industrial area covering the suburbs of Zetland, Beaconsfield, Alexandria and Rosebery. The 487 hectare area is undergoing what is believed to be Australia's largest urban renewal project. When completed in 2016 more than 25 000 people will live where once industrial buildings stood. One of the projects currently under construction in Green Square is the Metro development at Botany Road in Beaconsfield.

The project is a collection of nine buildings that will be built over 3 stages with 300 apartments, 1500 m^2 of retail space and associated parking being provided. The first stage, nearing completion, is for three buildings with 111 quality 2-bedroom and 1-bedroom units. The units are contained within two 7-storey and one 4-storey buildings. The second stage is due to start in the next few months.

The design uses precast floors and walls as the main building elements. These elements are readily available from the marketplace. Some 1200 precast panels ranging in thickness from 150 mm to 200 mm were supplied for the external and internal walls. Hollowcore floor planks, 1045 off, are used for the internal floor spans. The 200 thick planks span 8200 mm and the 150 thick planks span 4100 mm. Transfloor panels with an integral upstand of 1100 mm are used for the balconies.

A unique design feature that was developed for this project was the external precast wall to hollowcore floor connection. Traditionally a continuous corbel would be cast with the wall panel to allow the floor plank to land onto during construction. Due to the limited space available in apartment construction a temporary shelf angle is used with starter bars from the wall panels. The bars are grouted into selected cores of the floor planks. A comprehensive test report is available from the NPCAA that provides further details.

The builder, Baseline Constructions, undertook an exhaustive brief to develop drawings and construction methods that would deliver the most efficient product in appearance, marketability, structural efficiency, construction time and cost. Precast concrete was found to be the preferred option. Baseline had already experienced the benefits of hollowcore flooring and precast wall construction for an office building at Rockdale (see *National Precaster 26*).

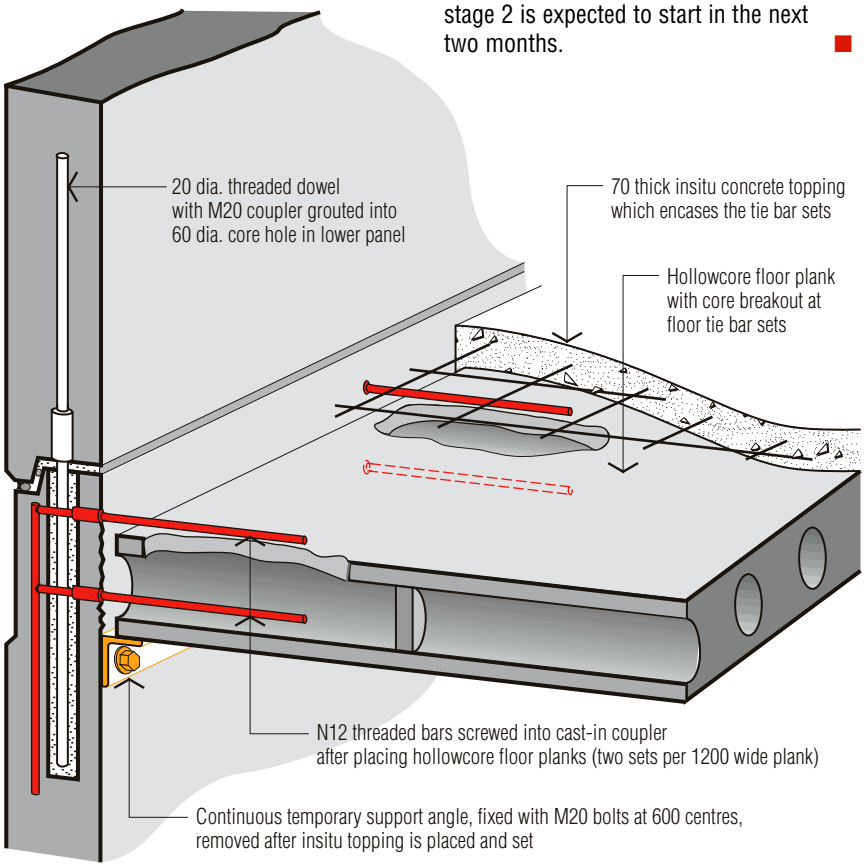
Test setup for a 1200 wide floor plank with the top flange removed from 2 cores. Two pairs of 2 off N12 reinforcing bars are screwed into ferrules cast into the wall panel. A RF72 mesh is positioned on top of the planks and a 70 mm structural concrete topping is placed that encases the N12 bars and provides a flat floor.

The precasters selected for the project, Girotto Precast for the walling and Rescrete Industries for the flooring, were chosen due to their experience and manufacturing capacity. Design development meetings were held with the builder, consultants and precasters from a very early stage resulting in a well planned manufacturing and erection sequence. Girotto undertook the precast erection.

The result was a project that delivered a pleasing and efficient design for the architects, ARC Architects. The structural engineers, Meinhardt (NSW) Pty Ltd, produced a significantly appropriate and efficient structure. The structure was completed including the roof in July 2002 with 17 levels of precast elements erected in 16 weeks. Since there is no propping of floor planks or formwork required the finishing trades can follow one floor below the structural work.

The site is clean and unimpeded and clear of the usual material stacking areas found on traditional sites. Safety and industrial relations are far more manageable with a minimum workforce required to construct the buildings. Project Managers, Peter Groenewegen and Alan McNamara said "there is just no comparison and we regard conventional building methods as antiquated and no longer appropriate".

A review is currently being undertaken by all parties to improve and refine the details for the later stages. Construction on stage 2 is expected to start in the next two months. ■



Wall and floor connection showing temporary shelf angle and gap between floor planks and wall panels that is filled when the structural topping is poured.

(left) Precast wall panels being exported for Christmas Island Detention Centre

MEMBER Profile

PRECAST WA PTY LTD, a relatively new and expanding Western Australian precast concrete company, was formed only 18 months ago under the leadership of Managing Director, Colin Parker. The company operates from premises in the suburb of Bentley. With the production facilities being fully roofed, the contracts are able to be completed on time to the client's schedule without weather interruptions. The factory currently has a lifting capacity of in excess of 25 tonnes with extensive steel tables to precast wall panels and beams.

One year ago Precast WA consisted of Mr Parker and one staff member, but in the past year the company has grown to a staff of 17. This company's first contract was for an up-market commercial and residential complex in a busy inner suburb near a railway tunnel.The location meant there were demanding truck and crane restrictions and the job was made even more complex as there were 64 different panels required, some 16 m high.

Since then Precast WA has successfully completed significant contracts such as staff accommodation units for the detention centre being built on Christmas Island. Consolidated Constructions decided to use precast construction to build the eight 16-unit accommodation blocks and the three smaller 8-unit blocks in the project.

"We have recently exported 364 panels up to 8 m by 2.2 m in two shiploads to Christmas Island. We believe this is a first in Western Australia and opens more opportunities for overseas markets," Mr Parker says.

The panels were manufactured using a special concrete mix designed by Associate Member, MBT (Aust) featuring Glenium 51, a water reducing hyper-superplasticiser. This has the following advantages for the client in terms of precast efficiency:

- Provides extreme workability with very low water/binder ratio giving high early concrete strengths.
- Allows concrete to be placed with high fluidity and neutral set.
- Allows early screeding and finishing.

The company also supplied the precast panels for the $3.8 million hockey stadium at Curtin University. These were up to 6.5 m wide and Precast WA had to build special transport frames to get them safely under police escort from the company's nearby factory.

The design required a wide diversity of panel sizes weighing from 1.5 to 34 tonnes, with many ranging in thickness from 250 mm at the bottom to 150 mm at the top and including angles and windows. Precast WA also provided panels for a Ball Wall around the second hockey pitch and all the precast tiered seating in this world-class stadium. Despite the complexity and logistics of the job, which started in December last year, the contract was finished in April, on time and on budget.

Precast WA is consistently winning accolades for the quality of its products and service and is set to expand even further for the supply of architectural panels as it builds on its growing reputation. ■

Hockey Stadium at Curtin University featuring precast wall panels up to 6.5 m width.

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NEW MEMBER

The President, Directors and Members welcome the following new Associate Member to the Association:

- **Cathay Pigments Australasia** – International suppliers of colouring oxides for concrete and masonry applications.

FOR FURTHER INFORMATION about the New Zealand precast industry including Member details, list of publications, visit Precast NZ Inc at:
www.precastnz.org.nz