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NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA

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Partially erected 18-unit building with rectangular polished floors

## PRECAST Protects the Diggers

*Set on a picturesque 1000 acre site at the foothills of Mt Stuart, Townsville, the Lavarack Barracks Redevelopment is setting new standards in Australian defence force housing.*

### DESIGN

The requirement for over 1000 housing units quickly led the design team to a prefabricated system using a precast concrete solution.

The precast concrete solution met the demands of the design brief which included the suitability to tropical North Queensland climate with respect to thermal and ventilation requirements, flexibility in layout, off-site manufacture and all within a tight budget. The panel and erection system was developed by the design team in conjunction with specialist precaster, Prestress Research and Products (Aust) Pty Ltd, a member of the Precast Concrete Pty Ltd Group of companies.

A full size single storey prototype unit was commissioned in October 1999, in order to fine tune the design and agree on the finishes for walls, floors, balconies and other internal elements.

The accommodation brief required 72 three storey buildings which comprised either 4 or 8 units for Officers and 12 or 18 units for Privates, with particular design suited to the environment, terrain and location within the barracks. The design varied for the Officer's quarters by modifying the ground floor units to undercroft parking and by increasing room sizes by a nominal one metre in width.

Adjacent to each building were free standing carport structures. At the end of each carport a three sided precast storeroom structure was provided in coloured concrete, fitted with a roller door on the front and a metal roof. Each accommodation unit had it's own lockable storage unit for personal belongings.

### MANUFACTURE

Full scale manufacture mobilised in December 1999, with the precaster establishing a manufacturing facility on the northern outskirts of Townsville. The facility was modified to accommodate the

demands for manufacture of 4270 floor, wall and balcony panels with a combined area of 53 000 m<sup>2</sup>, weighing in total some 23 000 tonnes. Factory modification required the establishment of an additional 3000 m<sup>2</sup> of storage area under craneage and the installation of 3 overhead cranes with 20 tonne capacity. Steel casting beds and the twenty four moulds required to meet the production schedule, were prefabricated in the precaster's Brisbane mould shop, transported to Townsville and assembled and seam welded to make up the required panel configurations.

Predominantly local labour and materials were sourced for the production

Completed standard 18-unit building with L-shaped floor configuration



## PRECAST Flooring Ready for Sound Impact

Whilst Australia may be a land of peace and wide open spaces, its city dwellers have for long been plagued by noise pollution for the simple reason that we have never paid enough attention to sound insulation of our apartments. That, according to one of Australia's leading acoustics consultants, Peter Knowland, is about to change: 'This will be driven by the proposed upgrade to the current Building Code of Australia (BCA) and the AAC Star Rating System for apartments. Both these events will have significant influence for the precast industry'. The key aspects of the proposed upgrade to the BCA are:

- 1 Recognition that the field sound insulation being achieved is often below that specified.
- 2 Introduction of a correction factor ( $C_{TR}$ ) to take account of the low frequency performance of walls and floors.
- 3 Introduction of impact transmission rating for floor systems.
- 4 Defining sound impact insulation requirement of walls in a more practical way. This is achieved by insisting on isolated double wall systems wherever a bathroom/ kitchen of one apartment abuts the bedroom/ living room of another.
- 5 The inclusion of water services piping to be insulated and isolated.
- 6 The introduction of  $D_{NTW}$  for on site verification. This is a simplified method of measurement that looks at the effective sound insulation between two spaces. This determines what people experience on a day to day basis when they live in that apartment.

Mr Knowland believes the introduction of impact rating for floors is absolutely necessary in the light of lifestyle changes. 'Carpet is being torn off floors at an increasing rate. Sometimes it's for health reasons, but mostly it is the new lifestyle. We show wealth with marble floors. And timber floors have had a new resurgence. Isolating these floor systems is not easy and even the best isolation does not really equal the performance of carpet'. It is essential that the concrete floor is very stiff for the isolation system to work. For further impact insulation, particularly to footsteps, the use of resiliently mounted plasterboard ceilings below the concrete floor will become commonplace.



*Customised counterweighted transportation rig for overdimensional panels – 11 m long and 5 m wide weighing up to 16 tonnes each*

with eight of the precaster's senior management and technical staff relocated to provide expert training, supervision and administration of the manufacture and erection process.

An average of 250 fixing ferrules were cast in each day to fine tolerances, for the precast structural steelwork and metal work connections, avoiding the need for site installed masonry anchors.

The typical building configuration comprised 3 storey with 6 rooms per level providing the 18 unit building. Typical wall panel sizes were 11.0 m tall by either 4.0 m or 5.0 m wide with weights up to 18 tonnes. Typical floors were 6.0 m long x 4.3 m or 5.3 m wide and incorporated a protruding nib for waterproofing. Floor slabs were prestressed to reduce the thickness to 175 mm and honed finished to expose the red reconstructed granite aggregate mix. The floors were steam cured to allow production and finishing of 5 units on a daily cycle.

The visible walls to each end of the building were manufactured in oxide coloured concrete, to reduce life cycle maintenance costs, whilst dividing walls were manufactured in grey off form concrete. All visible surfaces inside the rooms were manufactured to a high quality finish and painted. This comprised both faces of the wall panels and the soffits of the floor panels. All electrical, communication and security conduits and fittings, were cast into the panels so that there were no visible conduits and no ceiling space or wall cavity was necessary. Balcony panels were provided for each unit and broom finished in oxide coloured concrete.

After erection, the floors received 3 coats of a special sealer to provide a maintenance-free aesthetically pleasing surface.

### TRANSPORT AND ERECTION

Police escorts were required for the transportation of the wide floors for the Officer's accommodation. The units were

stockpiled and delivered in large numbers over a short period to minimise costs.

Wall panels were typically 3 storeys high with the actual dimensions varying from building to building to follow the slope of the natural ground. Custom transport frames were designed and fabricated by the precaster's Brisbane-based manufacturing facility and fitted to three low loader trailers owned by the local Townsville haulage contractor. The frames were designed to reduce the height of the load to a maximum of 5.1 metres, by tilting the panels on an angle and lowering the panels as close as possible to the road yet still keeping the centre of gravity as close as possible to the centre of the trailer. The frames were designed with removable struts to accommodate the various panel widths and the frames could attach to multiple positions along the length of the low loaders to take into account varying panel lengths.

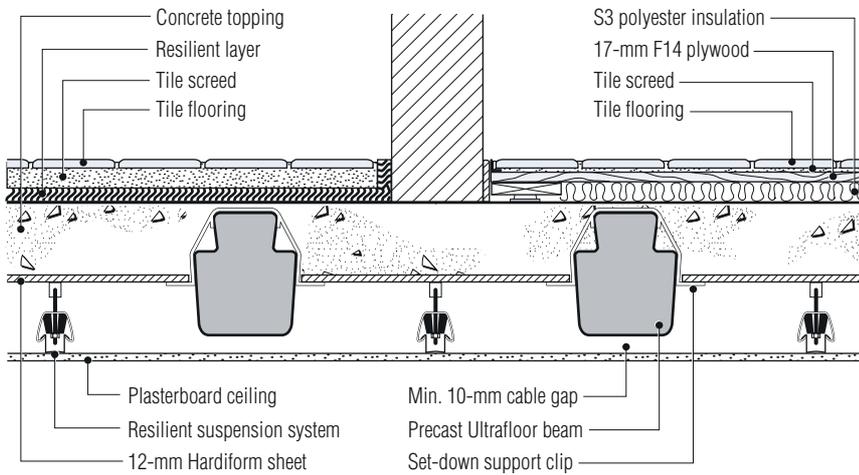
Prefabricated bathroom modules were installed once the precast erection was complete and were supported by the precast structure. Then followed erection of the steel-framed stairs and precast balconies, providing access to the first and second floors. Steel roofs were assembled on the ground, then erected and fixed to cast in ferrules in the precast walls.

The erection was carried out by an experienced crew of specialist riggers, using a 75 tonne crawler crane which achieved an average of 4 completed units per day over the project period.

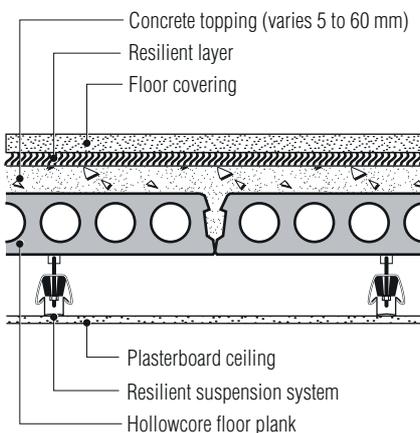
### SUMMARY

The completed units have been welcomed by the new occupants who now have thermally comfortable units with individual kitchenette, ensuite and private balcony deck which gives a sense of personal space inside the huge military complex.

The completed project was designed and built to blend into the natural environment at the foothills of Mt Stuart. Most of the trees and vegetation were retained and rehabilitation of the natural waterways with additional planting was carried out. ■



*Impact Sound Resistant Ultrafloor (showing two different systems, namely a resilient layer on the left and a floating floor on the right)*



*Impact Sound Resistant Hollowcore floor*

A key factor in choosing a precast floor system is the ability of the floor to accommodate the isolation of hard floor finishes without increasing dramatically the overall floor depth. The Ultrafloor system is flexible in this regard in that the insitu concrete between beams can, where structurally feasible, be set down so as not to reduce the floor-to-ceiling height and keep the finished floor level constant. This is achieved via the use of innovative set-down clips that lower the Hardiform™ sheets between the precast beams. Any step in the floor can be made modular with brick coursing.

In the case of hollowcore floor planks the concrete topping thickness can be adjusted anywhere from a self levelling screed of 3 to 5 mm to a structural topping of 50 to 60 mm. A structural check should be carried out to determine the minimum structural topping required in each application.

The precast flooring systems have very good sound insulation and this can be increased by the easy use of resilient layers and isolated suspension systems for

ceilings against impact sound. In providing additional impact insulation, a number of factors need to be considered:

- the nature of the floor surface,
- the nature of the ceiling system.

#### FLOOR SURFACE:

Soft floor coverings such as carpets (usually on underlay to improve matters) add to the impact insulation value, but hard coverings such as tiles, polished floorboard or parquetry make things worse. To deal with the challenge of hard floor surfaces, the following items may easily be added:

- A resilient layer placed between the structural concrete surface and a sand/cement screed. A good example of this material is Regupol, made from recycled car tyres.
- For extra insulation, a so-called 'floating floor' can be installed whereby the floor covering is placed onto a resiliently-mounted timber sub-frame and the void filled with insulation fabric.

#### CEILING SYSTEM:

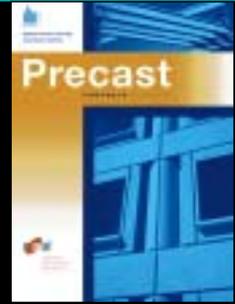
The ceiling system may be a standard-mounted plasterboard membrane, with insulation fill in the air void if necessary. However, to further reduce the impact sound, the mountings may be upgraded to resilient components that better isolate the ceiling from the hard floor above. Higher impact ratings are possible by using insulation fabric such as glasswool or polyester fill in the ceiling void, or extra layers of plasterboard or acoustic materials affixed to the ceiling soffit.

*For additional assistance in the application of precast flooring contact your local precast flooring manufacturer* ■

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## Precast

CONCRETE HANDBOOK

The NEW 350-page *Precast Concrete Handbook* is a joint publication of the National Precast Concrete Association Australia and the Concrete Institute of Australia.

It embraces all aspects of reinforced and prestressed precast concrete.

Based on the authoritative CPCI Design Manual (3rd Edition), the Australian *Precast Concrete Handbook* covers application, design (using worked examples), detailing, manufacture, handling and installation as well as contractual issues.

This Handbook incorporates revision of Concrete Institute of Australia Recommended Practices *Design and Detailing of Precast Concrete* and *Precast Facade Connections*. It complies with current Australian Standards as well as industry practice.

THE NEW *Precast Concrete Handbook* features twelve chapters and an appendix which provide comprehensive information as follows:

- Precast Concrete Applications
- Products and Processes
- Materials and Material Properties
- Tolerances
- Analysis and Design of Buildings
- Design of Elements
- Connections and Fixings
- Design of Joints
- Thermal and Acoustic Properties
- Architectural Elements
- Handling, Transport and Erection
- Contractual Issues
- General Design Information



## PRECAST Passes the Test

Test cricket in Tasmania will never be the same again after the completion of the redevelopment of Hobart's Bellerive Oval later this year.

Bellerive Oval, the home of Tasmanian cricket, is nestled on the eastern shores of the Derwent River approximately ten minutes from the Hobart CBD. It has been used for recreation in some form for around 100 years. However, it was not until post-World War II that both the Clarence Football and Cricket Clubs were formed. The Oval first celebrated international attention with a one-day match in 1988 followed closely by Bellerive's inaugural Test match in 1989.

The final design of the new Oval will create a world-class boutique cricket ground that facilitates the following:

- Improved player change rooms and practice facilities
- World-class dining and viewing
- Tasmanian Cricket Museum
- Improved media facilities
- Redeveloped member and corporate facilities
- More convenient public amenities such as toilets and kiosks.

These modern facilities will certainly be a far cry from the aluminium clad timber stands built in 1980, which kept cricket lovers only moderately protected from the prevailing cold south westerly winds over the last 20 years.

### Completed Southern Stand at Bellerive Oval ready for Test Match action

There are three stages in the \$16M project – The Southern Stand, Members Pavilion and The Pavilion.

The redevelopment lifts the old oval capacity from 11 000 to 15 000 with undercover areas lifted from just 3000 to 8500. The Southern Stand seats 6000 with a mezzanine level for bars, kiosks, toilets and a cafe area giving views of the Derwent River.

The project builder, Bells Constructions and Technologies Pty Ltd made the choice for a dominant proportion of precast concrete, not just for the ease of construction and aesthetic features, but to ensure that the 18 month construction time frame was met.

The extent of the precast componentry supplied by NPCAA Member, Duggans Pty Ltd, is as follows:

- Total no. of components – 1278
- Precast tonnage – 4400
- No. wall panel components – 509 (typical panel size 6.5 m height, 2.9 m width, 150 mm thickness)
- No seating units – 674
- Surface finish – Class 2 for wall panels
- Features – Exposed finishes, coloured wall components and some structural interfacing.

As a cost saving to the redevelopment, seating plats were recycled from the demolition of the Northern Stand and reused in the Southern Stand. These formed approximately 25% of the seating units with the new components designed to match the old. Tight coordination was required between the builder, the precaster and the steel subcontractor to coincide

with the removal and placement of salvaged components due to the lack of site storage space.

The completion of the first Stage Southern Stand was a good example of the 'just in time' principle. Within days of completion this stand was in use for the ING Cup match between Tasmania and Western Australia on 3rd November 2001, which was closely followed by a Sheffield Shield match and a Test match between Australia and New Zealand.

Construction of the Members Pavilion and The Pavilion (which houses the Tasmanian Cricket Museum) are well underway and are targeted to be completed for the next cricket season commencing November 2002. ■

Rear view of Southern Stand showing 6.5 m height coloured precast wall panels





## DOCKLANDS Going the Precast Way

The quickly expanding skyline of the Melbourne Docklands and Southbank precincts is a fine example of the Melbourne precast industry's impact on local construction. The prestigious New Quay development being undertaken by Bovis Lend Lease for MAB corporation includes three residential towers, retail areas, a marina and riverside boardwalks. This complex makes extensive use of structural and architectural precast. The advantages in both speed and quality of construction are visible to all and swiftly becoming more so as an increasing variety of multi-storey towers extend above the landscape.

The scope of the works is enormous. When fully developed, the New Quay development will eventually house 15 000 people and provide a workplace for another 20 000. The three towers each named after famous architects – Arkley, Boyd and Palladio, required well over 2000 precast wall panels, amounting to around 20 000 m<sup>2</sup>. Each tower existed as essentially a separate project. They were run in overlapping, though not identical, timeframes. This required for coordination between the precaster, Westkon Precast Concrete Pty Ltd, and the contractor to be

*Three-tower New Quay development under construction at Docklands including marina structure*

almost constant in order to ensure correct and efficient construction and delivery. At stages of the project the precaster had more than 600 panels stored in its yard in order to cushion the impact of three simultaneous towers working on quick cycle times floor to floor.

At level 18 on Arkley Tower and level 20 on Boyd Tower, the structure 'steps out' 625 mm over a 5.5 m length. Forming a slab 20 storeys up not a feasible proposition so the contractor turned to a precast solution. This was found in a L-shaped element, with a 1450 mm up stand and 2100 mm base spanning back into the building 1300 mm. The panel acted as formwork for a 700 mm deep slab and as a structural support for 5 floors of precast walls above.

Architectural requirements were such that all panels be in an unpainted finish and in their natural colours. Both plain grey and off-white cements were used though the various elements of the towers and consistent colour in the concrete mix was a high priority. This was achieved with the co-operation and expertise of the concrete supplier and the precaster to maintain the quality to match the architecturally approved samples over more than a year of casting. All exposed panels, although not painted, were coated with a transparent, penetrating silane/siloxane compound supplied by MBT. This weatherproofs and preserves the substrate of the panels without altering the natural surface texture or colour.

The marina structure at Nodal Point was constructed using precast bridge planks supported on Super-T prestressed girders. This was an exciting development as previously only insitu concrete was considered suitable for such applications – requiring a long design life under aggressive, corrosive conditions, (including partial submersion at high tide). Special concrete mixes containing Xypex C1000NF waterproofing admixture and concrete cover of 75 mm were required. The architecture incorporated split-levels and numerous set downs as well as a large number of penetrations. The use of precast elements facilitated this somewhat complicated exercise by providing an instant working platform and relatively easy setups, especially compared to the risky alternative of formwork over water. ■

*Erection of precast wall panels in Arkley Tower*





## MEMBER Profile

**GEocreTE**, a Division of Georgiou Group Pty Ltd, commenced operations in 1991 and has continued to consolidate its reputation as a reliable supplier of a broad range of quality precast concrete products.

Historically supplying precast products predominantly for use in underground infrastructure projects, the company has broadened its production capabilities during the past two years to reflect the diversity of its expanded target markets.

The emphasis on a broader market approach, has seen the company supply the reinforced concrete arches for tunnels on the southern railway link between Perth and Mandurah, approximately 80 kms south of Perth, and for a railway tunnel at Forrestfield, near Perth airport in Perth's eastern suburbs. Additionally, the company supplied precast retaining wall panels for the Forrestfield project. It has also supplied precast retaining walls and parapet walls for a new railway bridge at Shenton Park in Perth's western suburbs.

Geocrete's diversification has also seen it supply precast walling panels for the public amenity buildings at the Mandurah Ocean Marina, and an architecturally designed reinforced concrete bridge for a prestigious residential estate at Ellenbrook in Perth's Swan Valley.

Geocrete continues to supply reinforced concrete pipes, precast stormwater and sewer liners, lids, access covers and grates, headwall structures, and culverts for use in subdivisions and on major road projects. The company also supplies lightweight fibreglass reinforced plastic ladders, access covers and grating.

The Case Earth Award winning Thomsons Lake project at Jandakot, approximately 25 kms south of Perth,

*Kwinana Freeway Southern Extension – Glen Iris Tunnel – one of three tunnels constructed for the Perth–Mandurah railway line, 565 precast arches used in total*

required approximately eight kms of reinforced plastic lined sewer pipes and drainage pipes, ranging in diameter from 1050 mm to 1500 mm, as well as innovative precast access chambers. The precast access chamber option was submitted to the client, the Water Corporation of WA, as an alternative to cast insitu chambers, thereby lessening the need for expensive dewatering operations and significantly reducing the environmental impacts of the works in a sensitive wetland area.

Another recent pipe project included the supply of over 250 plastic lined pipes of 2100 mm and 1650 mm diameter for the Perth Main Sewer Replacement.

The company has also taken an active role in the promotion of Water Sensitive Urban Design technology. The 'Geotrap' stormwater all pollutant trap was designed by Geocrete and introduced into the WA marketplace in 2001, and has already won significant market share for the company in a highly competitive market. ■

*Architecturally designed precast concrete bridge in The Bridges residential estate, Ellenbrook*



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### NEW MEMBERS

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

- **Antonello Concrete Products** – Melbourne supplier of large box Culverts, bridge deck slabs, wall panels, beams/columns and psc fence posts.
- **Bianco Walling** – Adelaide precaster specialising in precast walling products.
- **Hicrete Precast SA** – Adelaide-based supplier of architectural wall panels.
- **Precast WA** – Perth-based supplier of architectural wall panels.
- **Sovereign Concrete Products** – Located in Ballarat, Victoria, major supplier of infrastructure products including box culverts, bridge components, and drainage products.
- **Ramset Fasteners (Aust) Pty Ltd** – national supplier of fastening systems to the precast industry.
- **Xypex Australia** – suppliers of waterproofing systems to the precast industry.