NATIONAL PRECASTER

NUMBER 66 • NOVEMBER 2012

ACN 051 987 181 • ISSN 1037-9908

www.nationalprecast.com.au

Dolphin dive

Construction of a 360-metre jetty and marine offloading facility was a crucial part of developing the new Gladstone Liquid Natural Gas (GLNG) plant and the success of one of Queensland's major mining projects.

Located on Curtis Island on the Central Queensland Coast, the extensive facility comprises a new barge berth, sea water intake pump support structure, adjoining passenger ferry berths and associated access catwalk, bulk aggregate berth and a load on-load off (LOLO)/roll on-roll off (RORO) facility.

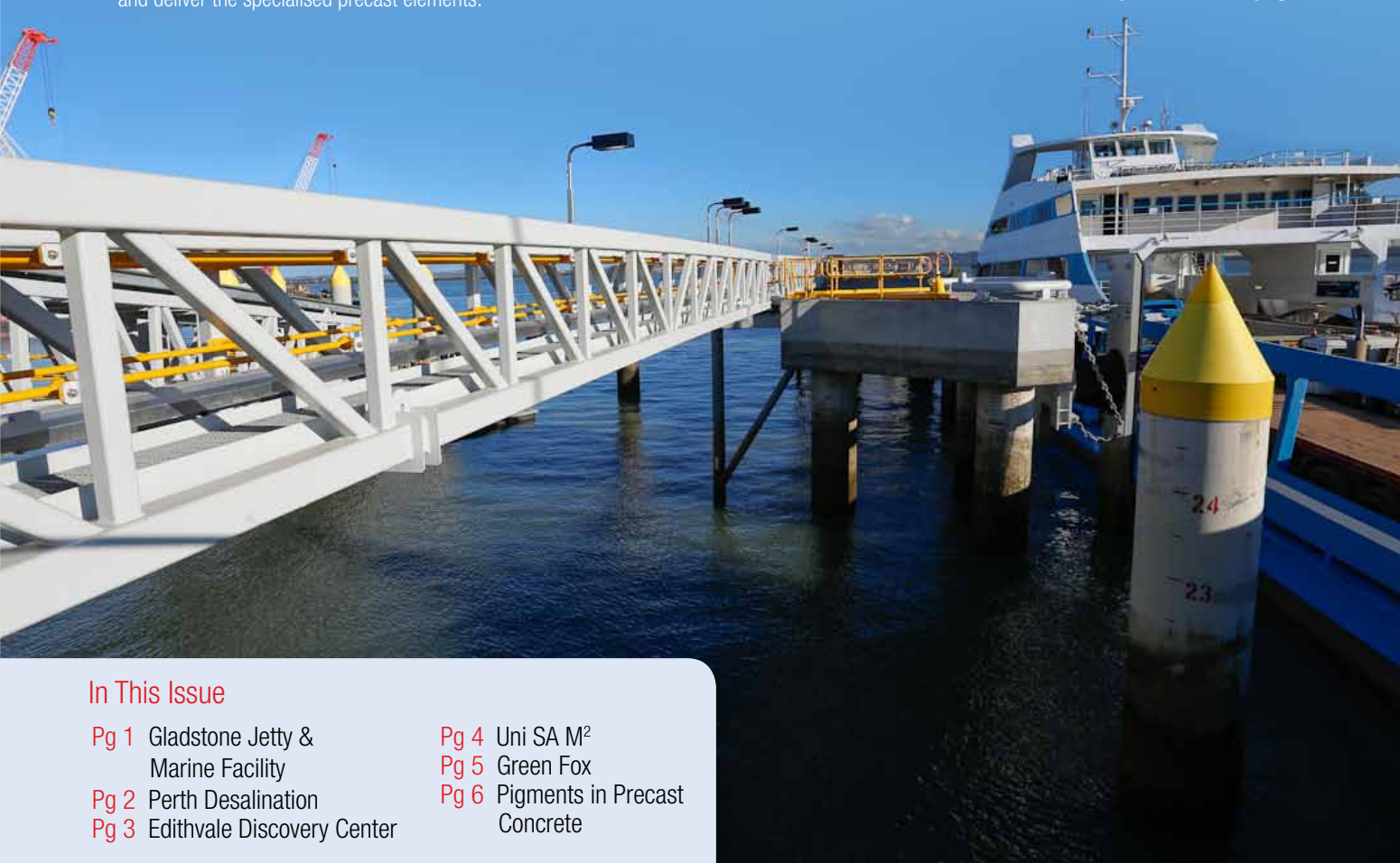
Construction of the new plant was taken on by Bechtel Oil & Gas on behalf of some of the world's best-known oil and gas companies, including Santos, Petronas, Total and KoGas.

A highly complex and large scale project, Bechtel engaged John Holland to oversee its engineering, procurement, design and construction. ARUP was selected as the engineer, while Stresscrete was chosen to supply and deliver the specialised precast elements.

The precast side of the project required work on a large scale. This included manufacture of 137 dead man anchors weighing 14-tonne each, 25 fender panels at 14-tonne and 11 'dolphin shells' weighing between 35 and 42 tonnes. The precaster also oversaw the procurement of structural steel cast-in items for the dolphins.

***Dolphins** are self-contained marine structures used for the mooring and berthing of ROPAX berthing vessels. They are essentially a structural, sacrificial formwork system which is permanently exposed. Soon after casting, all inner surfaces are green-cut, providing a construction joint surface for the in-situ concrete to bond to. The dolphins are supported on steel piles driven into the sea bed. Use of both dolphins and piers enables the overall size of the piers to be considerably condensed.*

...story continues on page 5



In This Issue

Precast concrete helps shape Perth's second desalination plant.

Perth's water shortage problems have been alleviated by the construction of a second salt water desalination plant by the WA Government at Binningup. The plant is 100% powered by renewable energy, uses reverse osmosis technology, and will deliver 100 billion litres of water per year to drought-prone Perth and nearby Bunbury.

The $955 million project is the largest integration project ever undertaken by the WA Water Corporation, and includes 13 large plant process buildings, an administration and control centre, ocean inlet and outlet pipelines, and major works to connect the new supply into the existing system.

A disused limestone quarry was the site chosen to help reduce environmental impact. Tunnelling methods were employed to construct the precast sub-sea pipelines; with minimal impact on sand dunes and to avoid closure of the beach.

Precast concrete was the natural choice for the building facades because of its durability in the extreme coastal environment, great acoustic properties, cost effectiveness and speed of erection. The planning and arrangement of buildings, the use of precast walls, and an 8m high vegetated berm help reduce the noise generated by the pumps used in the facility.

In 2010 Permacast was awarded the main contract to manufacture, supply, install, grout and seal 1035 precast façade panels for the thirteen process buildings. All panels have a design life of 100 years and were made with an S50 low heat concrete mix to meet durability requirements. Such a concrete mix produces a slow gain in early strength. Underground electrical tunnels were also required which involved the design and manufacture of 60 large inverted box culverts and 100 precast covers from steel moulds designed specifically for this purpose. To meet the tight construction program for stage one and two of the project, 31,000m^2 of precast panels were produced (200m^2 per day), and 2600 tonnes of box culverts, making this one of the largest precast contracts to be awarded to a local WA firm.

AJ Lucas, as part of the Southern Seawater Alliance, was awarded the contract to design, construct and operate the desalination plant, including ongoing maintenance of the facility for the next 25 years. Lucas drew on their trenchless technology expertise to install the intake pipelines, and the facility came online 3 months ahead of schedule and within budget.

Client: Southern Seawater Joint Venture
Builder: AJ Lucas
Architect: Parry and Rosenthal
Engineer: Worley Parsons
Precast manufacturer: Permacast

The Southern Seawater Desalination Plant has won a swathe of awards including the 2012 International Global Water awards 'Desalination Plant of the Year', the 2011 WA Engineering Excellence Awards, the Master Builders Excellence Award, and the 2012 Australian Architecture Award. Stage 2 of this project will be completed by the end of 2012, supplying up to 20% of Perth's water needs, and is a glimpse at what, one day, all plants will look like.


Photographer: Peter Bennetts

One for the birds

Lightweight and adaptable, GRC was the natural choice for this distinctive birdlife viewing station that seamlessly blends with its wetland surroundings.

Perched on Melbourne's outer fringe, in a Ramsar-listed world natural heritage zone that a host of rare bird species call home, is the Edithvale Wetlands Discovery Centre. Commissioned by Melbourne Water, the centre gives the local community, many of whom live in the suburbs directly adjoining the wetlands, a prime opportunity to observe their natural environment.

According to Jan van Schaik, from Minifie van Schaik Architects, it was the juxtaposition of the natural and urban environments that inspired the building's design.

"This was an interesting project because on the one hand you have the wetlands, but at the same time the area is surrounded by suburban homes. The intent of the design is to reflect this crossover between the urban and the wild. So, for example we have the naturalistic, idealised zoomorphic patterns in the building's façade combined with the building's roofline, which is angled to echo that of a suburban home," he explains.

Conceived as a series of viewing points to provide occupants with snippets of views from every possible angle, another design feature is the interesting window shapes, while the bright orange recycled material that wraps around the lower part of the building mimics the orange underside of one of the bird species that frequents the region.

The building also includes all the sustainability features one would expect in a building of this nature, such as composting toilets, solar panels, natural ventilation, double glazing and full insulation. And, in another nod to its special purpose, construction took place over two bird migration seasons, with workers downing tools when some of the transient birdlife moved in for a lengthy stopover on the annual journey south to the Antarctic.

Uniting all the building's elements is its glass reinforced concrete (GRC) shell. Supplied and erected by Asurco Contracting to meet exacting design requirements, the super-lightweight material was a natural choice for the project.

Because GRC weighs only around 10% of conventional precast, lighter custom timber moulding was able to be used to create the intricate valley-and-ridge pattern that is a signature feature of the building.

In addition, use of GRC meant there was no need for the cost, concern or environmental disruption involved in engineering and constructing heavy structural columns, that would have been required to support the full weight of a conventional concrete structure.

All up, some 40 wall panels of various sizes, totalling some 300 square metres, were used in the project. The panels are unfinished. The concrete has been impregnated with a pleasing charcoal pigment that takes on different hues according to the play of light on the surface.

As Asurco's Des Pawelski explains, the chief challenge in the job involved creating the moulds which would successfully recreate the complex and intricate patterns – some with valleys up to 200mm deep – that the architect required.

"Using GRC meant we could make moulds from laminated MDF boards direct from the architect's 3D drawings using a 5-axis CNC router," he explains. "We coated the custom wood with epoxy and a skin of tooling resin which worked very well for limited-use moulds. As well as giving us a precision finish, we also had to use four different moulds. If the panels were cast as conventional precast panels, then the moulds would have been far more costly."

The final result is one that ticks all the boxes: for aesthetics, environmental performance and cost-effectiveness.

Client: Melbourne Water
Builder: Built Vic
Architect: Minifie van Schaik
Engineer: Worley Parsons
Precast manufacturer and erector: Asurco Contracting

Rock star

Known as M², the newly built University of South Australia's Mineral and Materials Building has become a landmark at the University's Mawson Lakes campus.

The finished M² design exemplifies the blending of stylised form with function and exceptional environmental performance. With a design that both integrates and reflects many of the geological and mineral formations that its occupants study, the building also scores a 5 Green Star rating, with maximum emissions of 85kg of CO_2/m^2, in line with the university's exacting brief.

Working with builder Hansen Yuncken on the project, John Wardle Architects and Swanbury Penglase Architects conceived a 'stratification' theme that echoed the surrounding creek, lake and wetlands of Mawson Lakes.

Use of precast concrete for the building's façade was vital to successfully executing the stratification concept. Different colours, shapes and textures in the precast panels create a blurring of the building edges at the perimeter, helping with the integration of the building with the external landscape and creating a soft transition between inside and outside.

Speed and efficiency of construction was a priority for the project, and the building program was planned accordingly, with staged release of construction packages to allow commencement of the early stages before the final construction documents were issued.

According to Michael Favretto from Bianco Precast - which won the contract to supply and erect the precast elements – early stage planning and collaboration was the key to the project's success.

"We worked closely with the project team during the design development stage, even before we were appointed as precast contractor," he explains. "Our experience tells us that the more work that is done at an early stage to explore the design, cost and practical building solutions, the better the outcome for all concerned, and this project was a prime example."

A combination of steel moulds and concrete moulds was used to achieve maximum economy in the manufacture of the 201 differently shaped panels the building required. In all, this totalled some 2,200 square metres of intricately detailed colour-controlled panelling that was integrated with other high quality architectural finishes. "Aside from the extraordinary attention to detail required in creating the precast, the co-ordination of the panel construction and erection programme was critical because of the complexity of the job and the tight programme," recalls Michael Favretto.

"We had to maintain a high level of co-ordination between the engineer, the architects and the builder, including thorough 3-D modelling of the panel geometry, to simplify construction. For example, panels had to be erected and in place before insitu slabs were poured, and would be 'hanging' from the building. There were a lot of construction technicalities to deal with – but the result is well worth all the effort."

The end result has certainly more than lived up to its promise: an iconic building with its unique precast façade as one of its most distinctive elements.

Builder: Hansen Yuncken
Architects: John Wardle Architects & Swanbury Penglase Architects
Engineers: Wallbridge & Gilbert Engineers
Precast manufacturer and erector: Bianco Precast

...story continued from page 1

As Stresscrete's Craig Zinn explains, the biggest challenge for the job involved creating the formwork systems to accommodate complex shapes and other requirements.

"The steel reinforcing was quite congested and complex around the steel cast-in items and at corners where the base joined the walls," he explains. *"We used a high performance self-consolidating S50 concrete mix to assist the mobility of concrete around the congested reinforcing bars. To protect against the aggressive marine environment, the finished concrete was treated with a waterproofing protective coating."*

Transporting the 7-metre wide dolphins also posed challenges, and was achieved with the help of two police escorts, taking up two lanes of traffic on the Bruce Highway between Rockhampton and Gladstone.

Despite some of the logistical challenges, the clear advantages of using precast over casting in-situ were unmistakeable to all concerned, delivering time, cost and, perhaps most important of all, safety benefits that helped keep the project running smoothly despite tight timelines.

"The hazards of working over water are minimised with precast, because construction personnel work in a contained area with built-in edge restraints," says Craig Zinn. *"Using precast also means there is no need to assemble and strip complex framework systems over water, saving considerable time in construction and time working over the water, making it a far more economical option."*

Client: Bechtel Oil & Gas
Contractor/project management: John Holland
Engineers: ARUP (major works); Ashton Engineering (steel cast-in beams for dolphins)
Precast manufacturer: Stresscrete

Another dimension

A tight site, complex, multi-dimensional plan and strict environmental requirements were just three of the challenges overcome in the construction of this dynamically different Queensland office building.

The building is the Queensland headquarters of Kane Constructions, known affectionately as 'The Green Fox'. A three-storey building, it combines striking elevations with strong environmental specifications including reduced water and electricity use, extensive use of recycled materials and passive design.

At a mere 10 metres by 40 metres, built to the side boundaries and with a council-required setback of 3 metres to front and back, the tight site posed a key challenge and was a key driver for the choice of precast as the predominant form. Aesthetics was another major drawcard for both client and architect.

Even with the benefits of precast, installation of the panels – supplied by Austral Precast – required significant planning, ingenuity and engineering know-how.

The external walls weighed up to 18 tonnes each and required extremely accurate set out, as they sat on the site boundaries. This was achieved with use of a 200 tonne crane – a tight fit on the site and calling for extensive traffic management.

The height of panels and multi-levels of the building required complex engineering: panels had to be braced off each other then to the ground, to ensure braces from two-storey panels were not penetrating through a visible part of the off-form concrete ceiling.

The building's northern facade comprises precast concrete columns over two levels in random arrangement, separated by an in-situ concrete beam on a different plane. Challenges arose because the columns could not be propped traditionally, due to both aesthetics and formwork clashes. The solution entailed two parts: the first row of columns was held between the level one slab and the beam formwork, while the second row was constructed later between the then-poured beam and the roof slab formwork.

Despite the site challenges and the complex slab rebates and penetrations, the end result was a smooth installation with no errors – and a very happy client.

"It is only through pushing the boundaries of good design and application of technology, together with use of offsite manufactured materials, that innovation becomes mainstream practice", said David Rutter, Director of Kane Constructions. "It is this aspect of the project we are most proud of."

Client and Builder: Kane Constructions
Builder: Kane Constructions
Architect: MARC & Co
Engineer: Meinhardt
Precast manufacturer: Austral Precast

Photographer: Kate Mathieson

NUMBER 66 • NOVEMBER 2012

Pigments in precast concrete

Coloured precast is popular for use in architectural building panels, infrastructure projects, bridges, paving and street furniture. Colored concrete can be surprisingly affordable, even on large precast structures.

Pigments have been used to permanently colour concrete for about a century. The use of pigments in concrete enables architects and builders to emphasize the character, enhance the form, complement the natural hues of the landscape, and add life and value to a project.

Naturally occurring pigments are found in mineral rocks and range in colour from red, brown to yellow. Synthetic oxide pigments were developed to make additional colours and to create a more homogeneous particle size with a more uniform bulk density and water absorption. Synthetic pigments are generally preferred for all architectural concrete work and are more intense in colour than their organic counterparts, with excellent long-term colour stability. Green and blue pigments are processed from copper oxides and cobalt deposits, and can be very expensive.

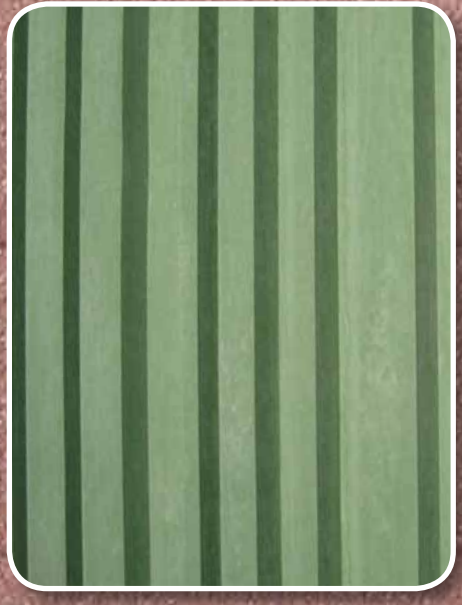
Integral concrete colouring using pigments involves adding a powder, granule or liquid pigment into the concrete mix so that the colour is bound into the concrete matrix. Pigment particles are finer than cement particles, so once added to the mix, will surround and coat the cement particles, giving the concrete its colour. The amount needed is typically 1-3% of the cement weight, although some projects may require as much as 6%. Any more and the colour becomes saturated.

The cement base will affect the final colour; a white cement base will give a lighter, brighter colour, a greyer cement will result in more muted tones. A consistent water:cement ratio must also be maintained to produce colour consistency in the finished product.

Coloured concrete will not fade over time if pure iron oxide pigments are used from reputable suppliers. Years of surface effects such as efflorescence, pollution, dirt and traffic take their toll on the concrete surface giving a faded appearance, however this can be avoided by regular cleaning and re-sealing.

Pigments have labour and materials' advantages over surface coatings such as paint. The use of coloured concrete means greater savings over the life cycle of the building as surface coatings don't have to be replaced; also eliminating the environmental burden of multiple coats of paint.

Marcel Linssen from Lanxess has the final word: "For best results the pigment dose should be adjusted according to the cement content. If used correctly, pigments will not fade and provide colour for life".



NATIONAL PRECAST
CONCRETE ASSOCIATION AUSTRALIA

CORPORATE MEMBERS

Asurco Contracting ■ [08] 8240 0999
Austral Precast ■ [03] 9794 5185 (VIC) or [02] 9604 9444 (NSW) or [08] 9493 5116 (WA) or [07] 3265 1999 (QLD)
Bianco Precast ■ [08] 8359 0666 (SA)
Delta Corporation ■ [08] 9296 5000 (WA)
Duggans Concrete ■ [03] 6266 3204
Hanson Precast ■ [02] 9627 2666
Hicrete Precast ■ [08] 8260 1577 (SA)
Hollow Core Concrete ■ [03] 9369 4944
Humes ■ 1300 361601
MJB Industries ■ [08] 9797 0999 (WA)
PERMAcast ■ [08] 9525 1380 (WA)
Precast Concrete Products ■ [07] 3271 2766
Quatro Design ■ [07] 5525 0775
Reinforced Earth ■ [02] 9910 9910
Rocla ■ [07] 3331 3515
SA Precast ■ [08] 8346 1771 (SA)
Stresscrete ■ [07] 4936 1766
Ultrafloor (aust) ■ [02] 4015 2222 (NSW) or [03] 9614 1787 (VIC)
Waeger Precast ■ [02] 4932 4900
Westkon Precast Concrete ■ [03] 9312 3688

ASSOCIATE MEMBERS

Actech International ■ [03] 9357 3366
Active Minerals International ■ [07] 4059 0648
Ancon Building Products ■ [02] 8808 1111
Aspedia ■ 1800 677 656
Barossa Quarries ■ [08] 8564 2227 (SA)
BASF Australia ■ [03] 8855 6600
Bennett Equipment ■ [08] 8268 1199 (SA)
Building Products News ■ [02] 9422 2929
Cement Australia ■ [03] 9688 1943
DesignBuild Source ■ [03] 8844 5822
Everwilling Cranes ■ [02] 9892 3377
Grace Construction Products ■ 1800 855 525
Lanxess ■ [02] 8748 3910
Nawkaw Australia ■ 1300 629 529
OneSteel Reinforcing ■ [02] 8424 9802
Pacific Computing (Australia) ■ 1300 769 723
Parchem Construction Supplies ■ 1800 624 322
Reckli Form-Liners & Moulds ■ 0418 17 6044
Reid Construction Systems ■ 1300 780 250
RJB Industries ■ [03] 9794 0802
SafePanel ■ 0448 778 055
Sanwa ■ [02] 9362 4088
Shore Hire ■ [02] 8708 1200
Sika Aust ■ [02] 9725 1145
Sunstate Cement ■ [07] 3895 1199

PROFESSIONAL ASSOCIATE MEMBERS

Aurecon Australia ■ [02] 9465 5751
Grant Thornton ■ [02] 9286 5850
Inhabit Group ■ [02] 8003 6333
Moray & Agnew Lawyers ■ [02] 4911 5400
Sellick Consultants ■ [02] 6201 0200
Tekdraw Drafting ■ [08] 8342 0500 (SA)

AFFILIATE MEMBERS

Baseline Constructions ■ [02] 9080 2222
British Precast ■ +44 (0) 116 254 6161
Precast New Zealand ■ [64] 09 638 9416

OVERSEAS MEMBERS

Golik Precast Ltd (Hong Kong) ■ 852-2634 1818
OCV Reinforcements ■ [66 2] 745 6960

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