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NATIONAL PRECASTER

NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA

NPCAA

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Quality Assurance Policy Statement

The Association supports, encourages and advises members in their efforts to achieve and satisfy clients' quality and quality assurance requirements.

This Association and its members are committed to providing real quality and quality assurance to users of precast components in accordance with the specification requirements for each project.

PRESIDENT'S COLUMN

Some months ago, the Construction Industry Development Agency (CIDA) published for comment a draft Code of Practice, *Key Performance Criteria*, a document outlining criteria for tendering for contracts. This document is but one of a number being prepared for CIDA by various Working Parties.

CIDA is a government agency with an express life of three years, during which its task is to provide the framework for a business and cultural change in the construction industry.

There would be little dissent that some change is necessary in our highly fragmented industry but not to the point of being made to feel ashamed of much of our performance. We should not lose sight of the fact that without bureaucratic intervention the Australian construction industry is highly regarded by overseas visitors to this country.

For subcontractors and suppliers it is disturbing to note the composition of the CIDA Action Team which developed this Code of Practice.

Of the twelve non-executive members of the team at least seven represented client interests, the remaining five included an Architect, a union representative and a solitary Head Contractor. Not a balanced representation by the widest stretch of the imagination and may well account for the Draconian nature of the team's recommendations.

Suffice to say, the draft document drew enormous criticism from those in the industry with the time and constitution necessary to read the draft. We now have the revised document for comment but apart from what is seen as minor, rather cosmetic change, the highly invidious nature of the original remains. For example, requirements within the financial section call for the Contractor and subcontractor to totally bare their company's financial structure including details of their current contracts. Some readers may say this is a good thing and had it been done before, there may have been less company failures. To those, one can offer qualified agreement; but stop to consider the danger of such financial exposure and the level of abuse of such information which will inevitably develop.

Finally, one issue seems to have been largely ignored, that of the selection criteria by the client in reality being heavily weighted towards the 'price factor' line. Until there is a genuine attitude to be prepared to pay for the 'quality company' or the 'quality product' all the motherhood statements about being interested in 'performance' will remain just rhetoric.

CAROL BERESFORD

MEMBER PROFILE

Since its incorporation in 1968, Precast Concrete Pty Ltd (based at Carole Park, around 20 km west of Brisbane) has developed an outstanding reputation for both its range of precast products and quality. Whilst possibly better known for its architectural work, witness the ANA Hotel, Sydney or its most recent project the High Court overlooking the Brisbane River, Precast Concrete is involved in GRC, hollow core (here operating under the name *Quickfloor*), structural precast and a wide range of very smart street and landscaping furniture. In this latter area the company supplied around 13 000 individual pieces of precast to the

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FACADE, ANA HOTEL, THE ROCKS, SYDNEY – A POLISHED, RECONSTRUCTED GRANITE FINISH

Brisbane Southbank project, formerly the Expo site, and a further 2900 items to the Pyrmont Bridge, Sydney redevelopment. The quality of the precast units, cycle racks, seating, bollards, paving, steps, copings and a host of other items, greatly assisting in making the latter a most aesthetically pleasing complex.

NAME: Precast Concrete Pty Ltd
ADDRESS: 70 Cobalt Street
Carole Park Qld 4300
MANAGEMENT:
Mike Wheldon, Managing Director
Ian Coulter, General Manager, Director

PRECAST LANDSCAPING, LITTERBIN, CYCLE RACK AND BOLLARD

PAVING AND COPING UNITS

Products
Architectural – elements, facades.
Structural – beams, columns, frames, bridge units.
Drainage – box culverts.
GRC – facades, permanent formwork, water-retaining structures.
Landscaping products ■

ACID WASHING OF PRECAST

Historically, precast manufacturers have used a weak acid solution of some 2–5% hydrochloric acid in water to clean the surface of panels prior to delivery.

Following manufacture it is common for the surface of the element to exhibit a thin, whitish film of water-insoluble calcium carbonate. Other salts of sodium and potassium may be present. These whitish deposits are barely noticeable on the lighter grey and off-white concrete surfaces, the darker the panel surface, the more noticeable will it be. Such dark surfaces occur with: polished granite finishes where dark coloured aggregate particles are present at the surface; concretes containing dark oxide pigments; and concretes having tooled surfaces (bushhammered/sandblasted), particularly if the coarse aggregates used are of a dark colour. Additionally, on polished surfaces of any colour this calcium-carbonate film will diminish the level of polish by reducing the level of reflection off the surface.

Precasters, through experience, recognise this cleaning treatment as a technically sound and cost-effective treatment. This attitude was confirmed recently on a Sydney CBD project where a light acid wash was recommended by the precast manufacturer. After concern about the process was expressed by the client, the builder and precast supplier undertook to investigate the likelihood of damage to panels.

Technical Information
Units Cladding panels
Finish Polished reconstructed granite
Mix

Cement (off-white)	480 kg/m^3
Sand	150 kg/m^3
Quarry Run (0.7 mm)	660 kg/m^3
Granite (7–16 mm)	980 kg/m^3
W/C Ratio	0.45
Plasticiser	600–1000 ml/100 kg of cement

Slump range 20–70 mm
Concrete strength 40 MPa
Water absorption (BS 1881 – Pt 122) 3.1%
Acid Treatment Approx 5% hydrochloric acid solution in water, applied for 5–10 minutes, subsequently washed off with water.

Testing
Initially it was the intention to test the surfaces of the panels for chloride ions by a process of leaching. This test, whilst providing a result was not considered conclusive, and further tests using Volhardt's method were carried out.

Leaching Tests
This test involved two test specimens, one of which had been previously acid washed (Panel A) and a control panel which had not been acid washed (Panel B).

Three 200-x 200-mm areas were subjected to ponding on each panel (using silicon bunds) with 100 ml of de-ionised water. The water was left for ten minutes and removed by suction. The samples were filtered through a 0.45-micron filter and analysed by ion chromatography. The results are shown in **Table 1**.

Whilst this test regime indicated that no significant residual chlorides were attributable to the acid wash, further concern regarding chloride ions at depth was raised by the client.

Volhardt Method
A subsequent test was conducted by drilling sample material from the face of panels, to a depth of approximately 15 mm. Six panels were tested with one of these acting as a control (untreated by acid cleaning process). Results were provided for two stages of drill sample (from approx 0–10 mm and 10–15 mm). Due to lack of a gauge rod, the depths of sample varied considerably.

The test was conducted using nitric acid digestion (Volhardt's Method).

The results of this determination are shown in **Table 2**.

It was agreed that a suitable yardstick for acceptability for chloride levels found was that specified in AS 2758.1 (0.4%) or that in Table 4.9.1 of AS 3600 (0.8 kg/m^3).

Conclusion
As can be seen from the results, chloride ion migration was not seen to

Table 1

	Panel A	Panel B
Micrograms of chloride per ml of solution (mean)	6.1	6.0
Mass of chloride ions present in bunded area	0.1067/g	0.1050/g
Mass of chloride ions as percentage of portland cement	0.004%	0.003%

Table 2

		Chloride Ion Content		Cement
Panel	Sample Depth	%	kg/m^3	%
1	0.5 mm	0.03	0.7	0.15
1	5–16 mm	0.01	0.24	0.05
2	0.12 mm	0.02	0.47	0.1
2	12–16 mm	<0.01	<0.24	<0.05
3	0–8 mm	0.04	0.94	0.2
3	8–13 mm	<0.01	<0.24	<0.05
4	0–7 mm	0.03	0.7	0.15
4	7–13 mm	<0.01	<0.24	<0.05
5	0–9 mm	0.02	0.47	0.1
5	9–17 mm	<0.01	<0.24	<0.05
Control	0–10 mm	0.02	0.47	0.01
Control	10–15 mm	<0.01	<0.24	<0.05

have occurred to any appreciable depth and certainly did not pose a threat to the galvanised reinforcement (at 40 mm depth).

The acid washing process did not significantly contribute to chlorides at the surface whilst a slight subsurface increase was found on some, but not all, treated panels.

The results of this exercise should be considered in light of the high cement content of the mix, the relatively low absorption value of the concrete and low concentration of hydrochloric acid used. A more porous or less cement rich concrete would not necessarily perform as well.

The obvious conclusion drawn from these test results was that panels were relatively unaffected by chloride ions as a result of the acid washing process and could be incorporated into the works without concern over their durability.

M G Symons and F J P O'Sullivan in their paper *Moisture and Chloride Movement Through Precast Concrete Panels*, presented at 'Concrete 93' (the CIA Biennial Conference), Melbourne give further credence to the use of acid solutions to wash down precast concrete panels prior to delivery. This investigation differed insofar that sample panels were subjected to a variety of surface treatments to expose the aggregate including acid etching, sandblasting and water blasting; all followed up with an acid/water solution cleaning programme.

Sample panels used a concrete mix with a cement content of 360 kg/m^3, a quantity at the lower end of the scale of precast cement contents. Further, acid/water solutions for washing down were 1:10 which would be at the maximum end of the scale for solution strengths.

The paper concludes by noting a sharp decline in chloride content with depth together with a marked decline in chloride content with time, indicating that the initial surface treatment technique exhibited no influence on the chloride ion concentrations present in the layers of the panel.

The chloride content of panels in the exposed environment were, in general, at levels which would be acceptable for reinforced concrete. ■

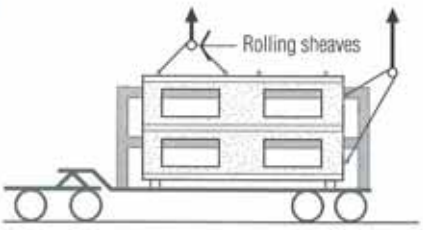
PANEL, TRANSPORTED HORIZONTALLY, USING AN 'A' FRAME SUPPORT BEING ROTATED TO THE VERTICAL USING ROLLING SHEAVE RIGGING SYSTEM.

TRANSPORT & ERECTION OF PRECAST CONCRETE

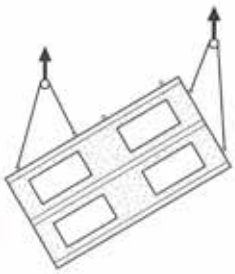
Within Australia movement by road is the most common form of transport for precast concrete although there has been satisfactory use of rail between capital cities. Road transport offers the advantage of factory to site with no intermediate handling.

Initial understanding of the Head Contractor's erection sequence and hence delivery requirements together with the proposed means of handling and site access must be determined at the documentation and tender stage.

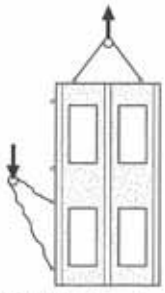
35-m-LONG, TYPE 4 PRECAST BRIDGE GIRDER WEIGHING 40 TONNES BEING POSITIONED FOR LAUNCHING, MITTAGONG BYPASS, NSW.



STEP ONE: Hooking onto unit on truck



STEP TWO: Turning unit



STEP THREE: Orienting unit for installation

ROTATION OF PANEL

Planning is essential

The best possible situation will be achieved when deliveries are planned to allow elements to be lifted directly from the delivery vehicle to their final position in the structure. Here, accuracy of the building set-out and precast manufacture, with a quick means of securing the unit in place will determine the time the vehicle remains on site and the length of time the precast unit remains on the crane hook, both very important considerations to the economy of precast construction.

The order of delivery is generally determined by the Head Contractor's sequence of erection and the Specialist Erector's day-to-day requests for components. Within this criteria, it is obviously advantageous to have as many units as possible conveyed on the delivery vehicle (within its legal load limit) and in an order which facilitates unloading in the desired sequence.

Unit shape will also determine loading, eg flat panels may be stacked flat or carried semi-erect, supported on an 'A' frame. The former method may be well suited to, say, hollow core planks whilst the latter would be applicable to architectural wall cladding, both methods allowing the units to be lifted direct. There are, however, no hard and fast rules, cladding panels may be transported flat and rotated to the vertical prior to lifting, it is essentially a matter of planning and understanding. Where adequate handling capacity exists, use should be made of large elements, these in turn providing quicker closure, less jointing, etc.

Experience gained by precast manufacturers in the delivery of large elements, particularly for civil engineering projects, has resulted in proven techniques for the proper support and bracing on the correctly chosen type of delivery vehicle.

EXAMPLE OF LATERAL STABILITY BRACING FOR 35-m GIRDER USING TENSIONED CABLE TIES.

TEMPORARY TRANSPORTATION FRAMES AND PACKING FOR CORNER FACADE UNITS.

PURPOSE-DESIGNED TRAILER FOR TRANSPORTING LARGE (DEEP) PANELS. NOTE THE SUPPORTING FRAMEWORK BELOW TRAY LEVEL.

Routing and Timing

Transporting large precast elements is governed by axle loading, obstructions and bridge loading capacities en route together with certain restrictions to the hours of delivery. Generally, these restrictions are:

Wide loads

- 2.6 m to under 3 m – delivery between 9.30 am and 3.30 pm.
- 3 m to under 3.7 m – delivery between daybreak and 7.30 am (escort required).
- 3.7 m to under 4.3 m – Saturday and Sunday, or in Summertime during weekdays between daybreak and 7.30 am (times must be approved and police escort required).
- 4.3 m and over – weekend delivery at approved times (police escort required). *Note that Police permits are required for all loads defined above as Wide Loads.*

Long loads (ie overall length of vehicle)

- 15.2 m to under 21.3 m – delivery between 9.30 am and 3.30 pm with some flexibility depending upon point of delivery and police requirements.
- 21.3 m to under 24.4 m – delivery between daybreak and 7.30 am weekdays or 8.30 am Sundays (escort required).
- 24.4 m – delivery between daybreak and 7.30 am weekdays or 8.30 am Sundays (police escort required). *Note that wide and long loads mentioned above are relatively unusual, the majority of precast elements use standard vehicles with arrival times at site distributed throughout the working day to suit the erector's programme.*

Loading the vehicle

Loading a delivery vehicle at the precast factory is carefully scheduled to meet the prearranged arrival time on site. An early morning delivery may be pre-loaded the working day before, an afternoon delivery may be dependent on the unloading at site of the morning load and the return of the vehicle to the factory.

In some cases, a loaded trailer can be left on the site to allow the prime mover to return to the factory for the next load.

The delivery schedule agreed between the Contractor and Manufacturer should always include an unloading time for delivery vehicles and a procedure for cancelling deliveries previously ordered. Extended delays to delivery vehicles on a site, or cancellation of a delivery after loading has commenced will result in increased costs to the Manufacturer, as a result of extra payments to the carrier. An agreed amount to recompense the Manufacturer for these extra costs should be considered in the contract.

The cost of delivery to areas close to an established factory generally do not exceed 5% of the total price; even long-distance transport can be surprisingly economical, especially for high-cost units where the cartage cost becomes a smaller part of the total price.

Cartage costs are assessed on the number of loads to be delivered and the minimum economical tonnage required on each vehicle. In most cases this will result in more than one precast unit being

delivered on the vehicle, the actual number depending on the carrying capacity of the vehicle, the shape or size of the unit, and stacking for ease of unloading at the job site.

Responsibilities

The Manufacturer is responsible for the product up to the point of delivery. Despite care in stacking and protection of components on the delivery vehicle, minor damage can occur. The precast industry is skilled in the repair of such damage and the opportunity should always be allowed for rectification. A procedure for inspection and acceptance of units on delivery should be agreed between the Contractor and the Manufacturer.

The Head Contractor should accept responsibility for good access to the lifting point. At the earliest point in the contract, he should discuss with the erection contractor the siting of temporary sheds, stockpiles of material and other likely impedance to good access.

Programming deliveries, transport and acceptance are normal activities which can become simple routine if reasonable communication and understanding is established. The Precast Manufacturer aided by the skill and experience of a quality erection contractor sets out to help the Contractor to build the structure. The delivery to the job of the correct unit at the agreed time is the culmination of his work. ■

'DROP-TRAILERS' LEFT AT SITE. ENSURES GOOD ERECTION CONTINUITY BUT SPACE NEEDED.

FIRM ACCESS AND EGRESS WITH ADEQUATE TURNING SPACE FOR CRANE AND DELIVERY VEHICLE IS VITAL.

HEADING FOR BIGGER THINGS

Two of the largest precast pipe-culvert headwalls ever used have been installed by Scone Shire Council.

Weighing over 27 tonnes each the headwalls (pictured) are 15.0 m long, 2.4 m wide and almost 3.0 m high and accommodate four 1800-mm-diameter concrete pipes.

Headwalls of these proportions were originally designed as an insitu product; however, Scone Shire Council Engineer, Kevin Tighe, has chosen to go with the precast product.

Precast headwalls with a known cost assist in bringing projects of this nature in on budget and reduce construction problems and site delays.

Products of this type are becoming increasingly popular with Councils and other Authorities throughout NSW. ■

HOLLOWCORE DESIGN PROGRAM

NPCAA has available *PCP3* a computer design program for hollow core planks in flooring applications.

More work is involved in designing a prestressed member, compared to reinforced concrete. The planks and structure have to be checked for a number of conditions, any of which could be critical:

- At transfer, where the prestress force is at its highest and the concrete strength at its lowest
- During handling and construction, where the plain plank is subject to dynamic and superimposed loads
- Under service loads before shrinkage and creep
- Under service loads after the effect of long-term shrinkage and creep
- At the limit state, where the structure approaches collapse.

Additionally, thought must be given to the differential shrinkage between the topping and the planks, and provision may

need to be made for the planks to shorten at supports.

It is the object of the software *PCP3* to simplify these tasks. It is available from:

- NPCAA at 25 Berry Street, North Sydney, 2060.
- Any of the hollow core manufacturers listed below:

Auscore Concrete Pty Limited
Tel: 059 77 4667 Fax 03 770 1976
Delta Corporation Limited
Tel: 09 296 4111 Fax 09 296 1184
Hollow Core Concrete Pty Limited
Tel: 03 369 4944 Fax: 03 369 2025
Quickfloor – Precast Hollowcore Products
Tel: 07 803 6388 Fax: 07 803 6383
Rescrete Industries Pty Limited
Tel: 045 77 5844 Fax: 045 77 6839
Spancrete of Australia Pty Limited
Tel: 02 671 6400 Fax: 02 831 5705
Westkon Precast Concrete Pty Limited
Tel: 03 312 3688 Fax: 03 312 4605

- The program's author Tel: 048 62 1295.

The cost of *PCP3* together with manual, is a very modest $295 per copy. ■

QUICK REFERENCE GUIDE

NPCAA has recently published a comprehensive guide to the range of products provided by each of its members. This is an ideal reference for Designers and Specifiers.

Write to NPCAA for your copy or phone 02 923 1244 or fax 02 923 1925. ■

NPCAA PUBLICATIONS
CURRENTLY AVAILABLE

National Precaster Issues 1 to 7
Gratis as available

Hollow Core Flooring Technical Manual *$10.00*

Hollow Core Walling Technical Manual *$10.00*

Precast Concrete Facades *$4.00*

Code of Practice for the Manufacture of GRC Products *$3.00*

Precast Concrete, a Selection Guide for Surface Finishes *$1.50*

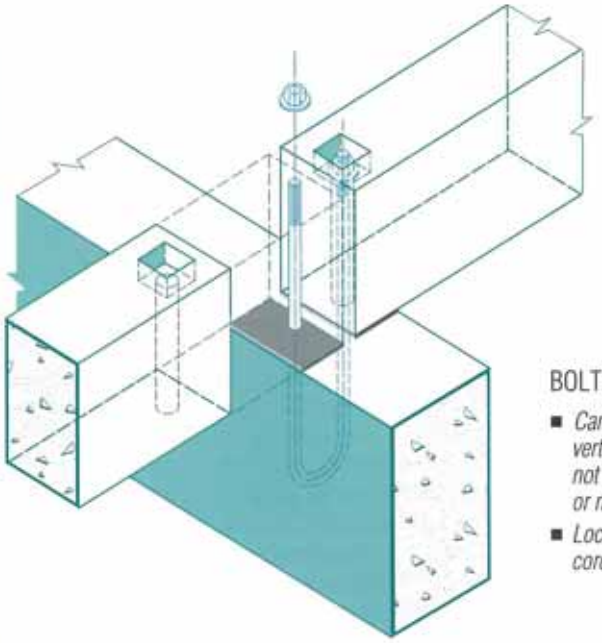
Structural Precast Advantage *$1.30*

Computer design program PCP3. A design program for hollow core floors. *$295.00*

TYPICAL DETAIL
THIS ISSUE: SECONDARY BEAM TO MAIN BEAM

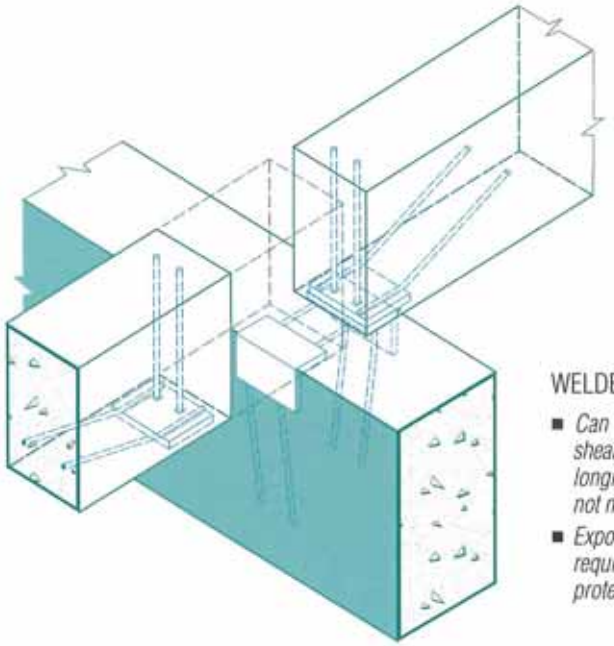
TOP CONNECTIONS OF SECONDARY BEAMS TO MAIN BEAMS OR GIRDERS

- *This arrangement allows the full section of the main beam or girder to be effective but increases the height of the building*
- *The greater part of the shrinkage and/or creep shortening of the secondary beams should preferably have taken place prior to their erection*



BOLTED

- *Can transmit large vertical shear forces but not longitudinal forces or moments*
- *Locating of bolts and cored holes is critical*



WELDED

- *Can transmit large vertical shear forces and small longitudinal forces but not moments*
- *Exposed steel sections require corrosion and fire protection*

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