VOLUME No. 1 • NOVEMBER 1990

NATIONAL PRECASTER

NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA

President's Column

The present state of the construction industry provides an interesting climate in which to launch a new national association. We are witnessing a period which has had no parallel since 1974. Clients and builders are going broke or closing down at a bewildering rate, investors are putting their money elsewhere and most Governments are cutting back on capital works.

Obviously the precast concrete industry is suffering along with everyone else but we are probably much better placed than in 1974. The precast industry is now much more commercially sophisticated and consequently less vulnerable. Many of our companies have been in business for over 20 years whereas in 1974 many were only 5 or so years old and had never seen a recession.

It could be that a recession is not such a bad time to start a new venture. At no other time in recent years has it been so obvious that we need to get the precast message out to our clients and to their consultants. In any event the National Precast Concrete Association of Australia now exists and will bring together manufacturers of a wide range of products including architectural facades, drainage products, hollow core walls and floors, street furniture and structural units for bridges and buildings.

We believe that the vitality and effectiveness of the industry will be enhanced by the formation of the NPCAA. Better communications between manufacturers will result in more technology transfer, in common approaches to QA and to better participation in codes and standards. The Association has already produced and published a Technical Manual for hollow core floors which links nine manufacturers in four States.

While not having access to the economies of scale available in the more populated countries Australian manufacturers are nevertheless world leaders in areas such as polishing and hollow core walls. The Association will be encouraging the development of Australian technology and techniques and will be reporting to you on these matters in future issues of The National Precaster.

John Burke

Precast goes National

This is the first issue of "National Precaster" to be issued by the NPCAA and thus the first to be distributed Australia wide. PRECAST began in the mid 1970's as a publication of the Precast Concrete Manufacturers Association of NSW and has been published regularly since then.

Our intention is to print material which is of interest to the specifiers, designers, users and final owners of the precast industry's products. It will contain items on technical and commercial matters as well as giving our clients information on the products and services supplied by our industry. ■

Introduction to NPCAA

The recent formation of a National Precast Concrete Association, stems from the belief of a significant number of Australian Precast Concrete manufacturers that a comprehensive approach to technical, contractual and marketing issues can only be achieved through the co-operation of the industry at a National level.

The aims of the Association accord with those of most trade and industry associations; to raise the image of the product through improved technical understanding, co-operation with other allied industry groups and intensified marketing using quality promotional material in printed and other visual form.

To this end the Association will function as a two-tier structure, the National Council being responsible for National policy issues supported by a number of "product groups" composed of manufacturers having like interests such as architectural cladding, structural units, permanent formwork etc. The groups will develop programmes of research and promotion in their specific fields.

John Burke, Rescrete Industries, is the inaugural President with Ivor Jones, formerly of the Cement and Concrete Association of Australia appointed as Executive Director. ■

Payment for goods off-site

The very nature of precasting means that significant funding is required for products held in precast yards awaiting delivery. The problem lies in deciding who should provide that funding – a matter of great importance to the precast industry.

A new wave of concern seems to have swept through our clients over the past year and many of them are now demanding contracts which do not provide for off-site payment or which provide for it only if precasters offer security. Documents such as the Natspec preliminaries are promoting the latter concept.

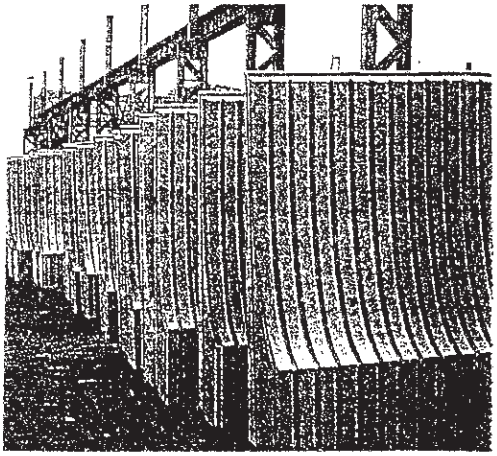
The precast industry will resist these pressures because they will result in additional risks which cannot be justified on any commercial or equitable basis.

Precast products can be divided into two categories:

• ***STANDARD PRODUCTS***
not manufactured for a particular client. Obviously the precaster must fund stock of this kind.

• ***SPECIALISED PRODUCTS***
manufactured for a particular project for which precasters normally require payment.

Typically a precaster will enter into a contract to manufacture to a particular schedule but, for a variety



▲ Precast cladding panels awaiting delivery

of reasons, is unable to deliver immediately following manufacture. These reasons usually include:

- Time is required for curing;
- The client doesn't want delivery until a group of products is available;
- The client's project falls behind schedule.

The precaster has usually also incurred costs in shop drawings, mould manufacture and other preliminaries.

THE EXTENT OF THE PROBLEM

If we take a multi-storey cladding project worth $1,000,000.00 then the expenditure before the first delivery may be:

Shop drawings	$ 50,000
Samples etc	$ 5,000
Moulds	$150,000
) floors of product	$300,000
	$505,000

Thus one half the contract value can be expended, usually over a period of about six months, before a panel is delivered to site. Once deliveries do start, the situation does not improve if the manufacturer continues to produce at the same rate that deliveries are proceeding. Only after manufacture is complete will the off site component start to diminish.

Of course builders usually fall behind schedule for weather, industrial or other reasons while wanting the precast to stay on schedule. This can greatly exacerbate the funding problems by both extending the time as well as increasing the amount.

WHO SHOULD PAY?

There are several considerations which all indicate that the precaster should not have to fund stock held off site.

- Funding for a project is the role of the owner. He expects to make progress payments as work proceeds. Builders are paid for all their work on a progress claim basis and precasters should be similarly reimbursed.
- The precaster does not control the risk arising from delays in design or construction and hence should not be asked to accept that risk.
- A precaster who is not being paid monthly for all work done is exposed to greatly increased risk in the event of the builder or owner collapsing.

SECURITY FOR MATERIAL OFF SITE

While the prime motivation for clients resisting paying for off site material is to limit their cash needs, the reason more often given is the exposure to risk. There is concern that the precaster will go into liquidation or become bankrupt or that the material will be damaged, lost or used for other purposes. In all of these instances there is a risk that, in addition to the loss of money paid for goods off site, the whole project will be delayed and costs increased through having to re-manufacture on a crash schedule.

Experience indicates that such concerns are unfounded but some forms of contract call for precasters to supply a bank guarantee or other such security for the full value of off site material. This is unacceptable to most precasters because they in turn would have to supply full security to the bank issuing the guarantee. This may be beyond their resources or greatly limit their access to bank funding for working capital or expansion.

The most efficient way for the client to limit his risk is through a combination of steps:

- All material held off site should be fully insured under an appropriate insurance policy.
- Ownership in material paid for should formally pass to the client and material should be clearly identified as to ownership;
- Schedules should be monitored to ensure that the value of off site material is kept to a minimum;
- Clients should ensure that the selected precaster has the financial strength to complete the project. The lowest price won't always be the best price.

THE EXPERIENCE TO DATE

An informal survey of experienced precasters has found no evidence of a client ever being damaged because of a precasters financial failure. The fear shown by so many of our builders, clients and financiers is therefore not based on real experience. There are of course many instances of proprietors and builders failing before paying for goods which are on site and thus it would be appropriate for them to provide security for payment rather than security being provided by the precasters.

SUMMARY

The precast concrete industry does not believe that it has a role in funding the construction industry other than by granting conventional 30 day terms. Off site payments should be made for all work done in exactly the same manner that monthly payments are made for all work done on site.

Any risks arising from the possibility of failure of a precasting firm can be countered by proper insurances and evidence of ownership. Bank guarantees given by precasters are not appropriate because they cannot be obtained without dollar for dollar security.

No precaster should consider entering into any contract which excludes payment for off site materials. To do so would be to accept greater exposure to risks, such as consequences of extensions to the construction programme and to business failures among builders and developers, over which the precaster has no control. ■

Case study

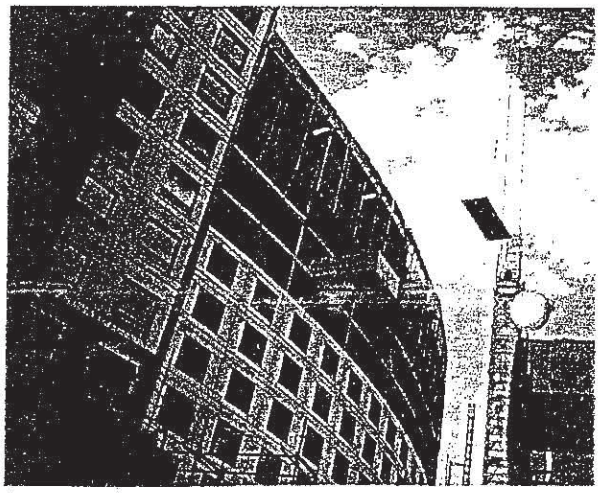
Transfloor's precast, permanent formwork floor panels have been successfully used in the construction of a new 700 room hotel, the Corn Exchange in Sydney. With architectural concept, structural design, project management and construction by Civil and Civic it was possible for that company to work closely with Transfloor to develop early in the job a number of refinements to its standard product. These included; provision of all slab penetrations for services, the addition of top mesh reinforcement to give protection to the polystyrene void formers and, by providing continuous top reinforcement, minimise on-site steelfixing.

Transfloor panels are used on all typical floors, typically 2500mm wide and cast to a trapezoidal shape to match the 4° taper of the radiating band beams. Spans vary from 6.48m to 8.86m.

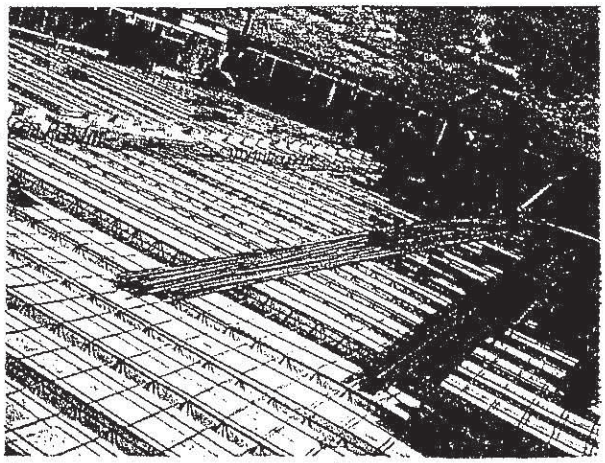
Panel placement was approximately 200m²/hr generally providing an eight day floor cycle.

For a complete case study of this project contact the manufacturer, Transfloor Aust Pty Ltd, Melbourne and Sydney ■

tel (03) 369 3555 • (047) 35 3333



▲ Transfloor permanent formwork floor panel lifted into place.



▲ Immediate and safe working platform provided. Note top reinforcement prefixed by welding to cast-in trusses.

BY DAVID MAHAFFEY*
*David Mahaffey is General Manager of BEMAC Laboratories Pty. Ltd.

"Concrete Durability – A function of water content, not just water-cement ratio"

Some specifications now contain a requirement for total water content, not just a maximum Water/Cement ratio. National Precaster presents a Consultants opinion.

When AS 3600 was introduced, new, higher standards were set in an effort to achieve more durable concrete structures. By specifying high strengths, minimum cement contents and increases in cover, this standard has taken great strides towards improving the quality of concrete used in buildings. Although these measures constitute considerable improvements over the previous code, it is possible to improve concrete quality even further by limiting the total quantity of water used in the concrete.

Concrete strength is a function of water-cement ratio, and the higher strengths specified in AS 3600 are designed to provide upper limits on water-cement ratio. Based on current thinking, specifying low water-cement ratios should guarantee concrete with good durability characteristics. This is not the case however, as a high level of durability can only be achieved when low water-cement ratios are accompanied by controls on total water content.

Concrete durability is generally taken as its potential to prevent corrosion of reinforcement embedded in concrete. The term could also be extended to include such things as breakdown due to freeze-thaw action, and also the potential for concrete to crack. In terms of reinforcement corrosion, the amount and quality of concrete cover will determine when, and if, corrosion will occur. It is the quality of this concrete cover that can be affected by the amount of water used.

It is known that only part of the water used in a concrete mix is necessary for the hydration of the cement. Various figures have been put forward, and for the purpose of this exercise a water-cement ratio of 0.23 will be adopted. On this basis, a mix containing 300 kg of cement requires around 70 litres of water for the cement to hydrate. If the mix has a water-cement ratio of 0.6, the total free water would be 180 litres, giving a pore volume roughly equivalent to 110 litres/cu.m. If, however, the water content was increased to 200 litres, and an increase was also made in cement content to maintain a water cement ratio of 0.6, around 77 litres of water would be required for cement hydration, leaving a pore volume of around 123 litres/cu.m. Even though both concretes have the same water-cement ratio, the porosity of one will be significantly higher than that of the other. It is interesting to note that the mix with the higher porosity is also the mix with the higher cement content.

A programme of testing was undertaken by BEMAC Laboratories to show the effect changes in total water content can have on the properties of concretes having the same water-cement ratio. A total of nine trials was carried out, all prepared by adding various combinations of dry aggregate to a fixed water-cement ratio slurry. Four of the mixes had a water-cement ratio of 0.5, and the remainder had a water-cement ratio of 0.65.

By varying the aggregate proportions, it was possible to achieve mixes with the same water-cement ratio and slump, but with varying water contents. Tests were carried out on samples from each mix, and these showed that concrete properties varied in relation to total water content.

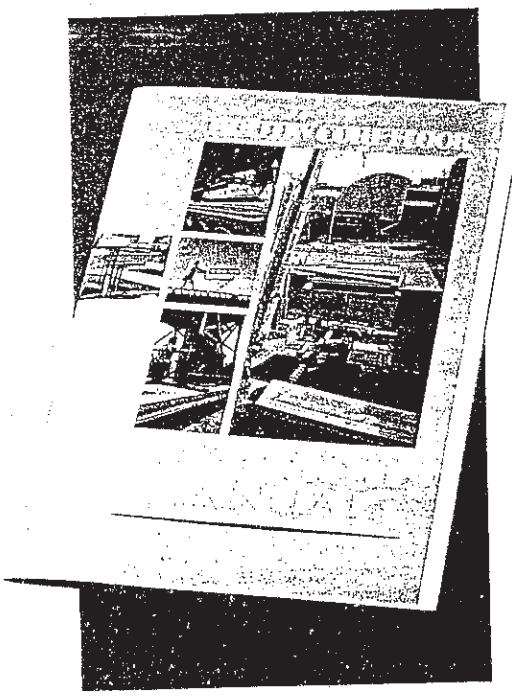
Tests were carried out on each mix to determine water absorption, resistance to freeze-thaw action, shrinkage and chloride ion penetration. In every case, the samples from the lower water content mixes performed better than samples from high water content mixes, regardless of water-cement ratio.

In each series of mixes, the concrete with the highest water content had an absorption around 70% higher than the lowest figure achieved, which was for the concrete with the lowest water content. Similarly, shrinkage results varied from a low of 420 microstrain for the lowest water content mix up to a high of 880 microstrain for the mix with the highest water content. Mixes with high water contents showed signs of cracking when exposed to cycles of freezing and thawing far earlier than mixes with lower water contents.

Testing for chloride penetration was carried out by ponding salt water on top of samples from each mix for a 24 hour period, then sectioning the samples, and determining the chloride ion content of each section. For each depth tested, the measured chloride ion contents were highest for the mix with the highest water content, and lowest for the mix with the lowest water content. For example, results varied from a high of 0.10% to a low of 0.06% at the same depth for each mix. It is probable that the differences would be even greater than this if the testing was carried out over a longer period.

In summary, the programme of tests outlined briefly above shows that low water-cement ratios are not sufficient to guarantee durable concrete unless steps are taken to limit mix water contents. Clearly, the use of concrete with a low water-cement ratio is the first step in manufacturing good quality, durable concrete. Further to this, careful mix design, use of good quality aggregates and informed use of admixtures, all with the aim of reducing total water content, will provide concrete of an even higher quality. ■

The opinions expressed in this article are not necessarily those of the Precast Concrete Industry. The Association welcomes informed comment from readers on this or other topics in this issue.



Technical manual

The Hollow core Product Group has produced the first of the Associations technical studies. Prepared, by Geoff Verge of Wood and Grieve Verge, Engineers with co-operation of industry specialists, the document is intended to assist designers in the assessment of the suitability of hollow core floors and to provide basic design information. It treats hollow core as a generic product, requiring the designer to ensure that units of the required load capacity are available from specific manufacturers.

Hollow core planks are precast, prestressed units produced on long line beds, using slide forming or extrusion techniques. Plank widths are usually 1200 or 2400mm and thicknesses varying from 100mm to 300mm.

The document deals with;

- ☐ *Planning and design;*
- ☐ *preliminary design check list;*
- ☐ *fire rating;*
- ☐ *sound insulation;*
- ☐ *durability and exposure conditions;*
- ☐ *plank sections and capacities;*
- ☐ *design of hollow core planks;*
- ☐ *construction details and procedures;*
- ☐ *guide specification;*
- ☐ *sample calculations.*

The document is available from Regional Offices of The Cement and Concrete Association Australia in all Capital Cities at a cost of $10.00.

Precast cladding

At a recent conference, "Facades and Coatings" (Sydney 23-24th July 1990 hosted by IIR Pty Ltd), several speakers gave the precast concrete industry, particularly those manufacturers engaged in the production of architectural cladding a deal of encouragement. This was identifiable in statements by several speakers who identified a return to the increased use of precast concrete facade cladding, resulting from;

- ☐ Evidence of the overall adequacy, in terms of durability of precast concrete facades on countless Australia-wide buildings.
- ☐ The pleasing appearance and effective weathering of polished precast facades offering colour range and capacity for surface modelling.
- ☐ Competitive life-cycle costs after allowance for re-caulking of joints and cleaning.
- ☐ Degrees of dissatisfaction with other materials.

With few exceptions the history of precast facades and resistance to durability failure is good. Indeed, looking across the skyline of any Australian city noting the large number of buildings using precast facades one would have to note that an insignificant number have suffered the indignity of being clad in scaffolding whilst repairs were effected. The Building Research Centre, University of New South Wales, confirms the low incidence of precast failures in their research paper "Concrete Durability". Logically of course, this is what one would expect of a factory produced unit benefiting from the experience of a regular workforce and close control.

A number of Sydney buildings have recently been investigated as part of refurbishment programmes or, in the case of the Commonwealth Centre, Chifley Square demolition. These include, the Opera House, Norwich House and the Commonwealth Centre. All have survived some 20-25 years with no discernable degradation of the precast. This pattern can be seen in all Australian cities.

In the case of Norwich House, David Tregoning, Partner, Woods Bagot, Architects, speaking at the Conference on "Facades and Coatings" referred to a recent investigation of the facade as part of a refurbishment programme. Only on the Western side was it necessary to replace the joint sealant. The precast and fixings, together with the sealant on the remaining facades were all found to be in good order. A panel recovered during the demolition of the Commonwealth Centre was tested for carbonation, absorption and Chloride ion content. This building, possibly the first use of polished precast facades, was some 27 years old. Details of the test results will be published in a later edition. Suffice here, to recognise that the results were within the limits of the current AS 3600, whilst galvanised fixings were in excellent condition. We should also bear in mind that when considering buildings of say 25 years of age, allowing for documentation, tendering and construction we are in fact considering the technology of at least 30 years ago, a period during which technology and understanding has significantly developed; we are for example on our third Australian Standard relating to the design of concrete structures in that time period.

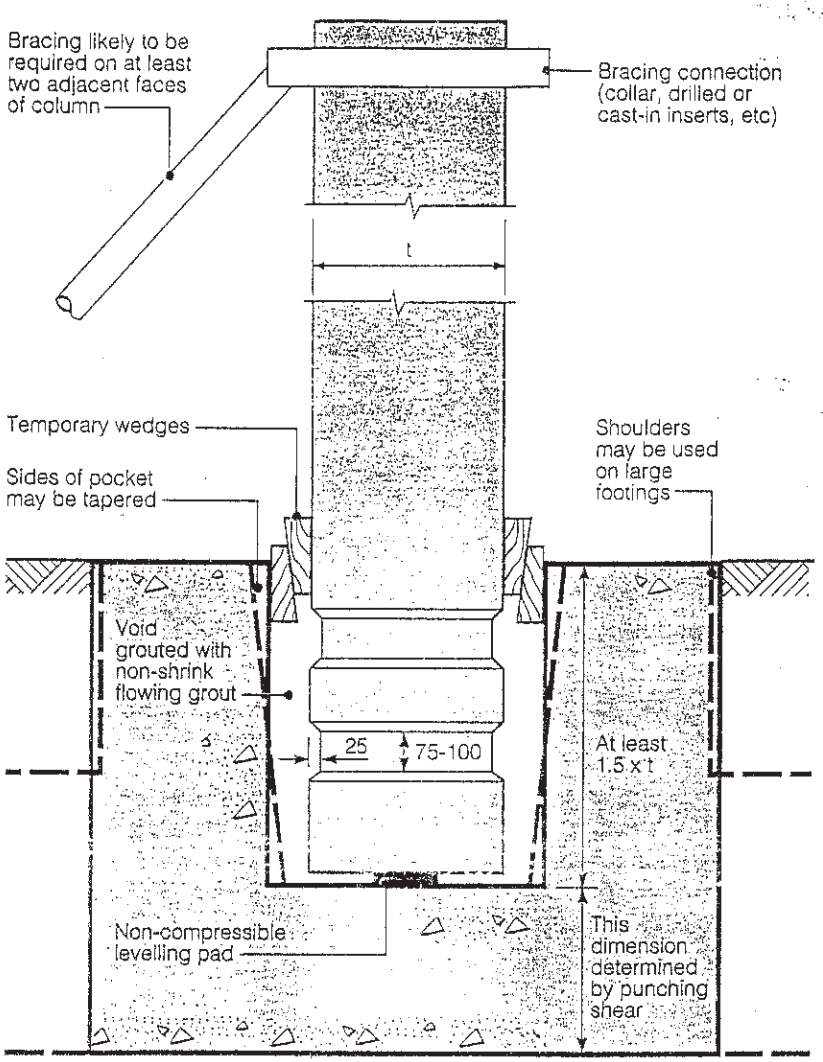
Peter Hartog, Architect, Building Diagnostics Asia Pacific speaking at the Conference suggested a swing back to the solid facade materials of natural stone and precast offering a capacity for surface modelling, colour, contrast and texture, his belief stemming from market pressure, public taste and the demands of regulatory authorities. Hartog, posed the likelihood of combining precast concrete with a lightweight facade fabrication, a presumed reference to the use of thin precast panels mounted on metal frames. Significantly, certain Australian precasters have investigated the use of thin precast concrete panels for incorporation into a curtain wall arrangement and this technique is likely to be used, featuring a polished finish on a major Sydney development near Central Railway.

Unquestionably, the architectural cladding manufacturers have reason to be confident; the wider availability of polished work, (available from manufacturers in all States) offer clients and designers a range of colours, patterns and finish well able to handle weathering and the environment. Additionally, the ubiquitous and well-proven water-washed finish, together with other, as-cast, tooled or applied finishes offer the designer a wide choice of surface shape, texture and colour.

Thermal advantages, off site-manufacture, capacity for pre-glazing, application of pre-delivery coatings are all 'pluses' for precast, but that's another 'storey' or more. ◻

TYPICAL DETAILS

THIS ISSUE: COLUMN TO FOOTING



SOCKET CONNECTION - COLUMN TO BASE

This method provides:
significant tolerance for the location of the column;
large moment transmission

Published by the National Precast Concrete Association Australia. 25 Berry Street North Sydney NSW Australia Phone (02) 923 1244