NUMBER 16 • JULY 1997

NATIONAL PRECASTER

NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA

NPCAA

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Mironi Manufacturing Pty Ltd
Reid Construction Systems Pty Ltd
Smorgon ARC
Sunstate Cement Ltd

Change of Address

Readers should please note that the National Precast Concrete Association Australia has re-located. Details are –

Postal address for all correspondence:
PO Box 774 Warners Bay NSW 2282
Telephone/Fax: 02 4942 7210

PRESIDENT:
R (Bob) Attwater Auscore Pty Ltd

EXECUTIVE DIRECTOR:
Ivor Jones

ERECTION OF PRECAST PANELS – ATHLETES' VILLAGE

MEMBER PROFILE

Westkon Precast Concrete Pty Ltd started in 1987. The Company's works and offices are located in Sunshine, 15 km west of Melbourne's CBD and is well served by utilities, land area, transport, concrete and reinforcement suppliers. The Company employs more than 40 production people and has built up an expert team to support these operations. It operates a Quality Assurance Programme to ISO 9002 standard.

Westkon is a leader in the manufacture of large prestressed concrete members, such as beams 40 m long and up to 75 tonnes. It has the largest permanent pre-stressing bed in Victoria.

It produces Dycore hollowcore wall and floor panels in addition to other pre-stressed products. It also operates a large panel vertical casting, battery mould and makes traditional wet-cast grey panels in a very efficient and cost effective manner. The Company of late has been heavily involved in the supply and installation of wall panels for medium density housing and shopping centre complexes.

Westkon is also involved in the production of architectural type precast units. It has worked with Vic Roads to develop and manufacture architectural finishes for sound barrier precast wall panels on a number of road projects.

On a recent project, the Melbourne Casino, Westkon designed and developed a precast concrete facade fixing system, for panelised sandstone. Sandstone panels were preassembled onto a precast concrete backing panel, in our factory, and erected on-site as a complete unit thereby saving considerable time for on site erection.

Westkon's experience in the medium density housing market led it to South East Asia in 1996.

In December 1998, Thailand will host the 13th Asian Games. One of the major projects, the construction of fully pre-fabricated buildings 8 to 14 storeys high, for the Athletes' Village was awarded by the Ministry of Finance to the Italian Thai Development Public Co. in July 1996. In the project there are 5000 one and two bedroom units which will eventually become student accommodation for Thammasat University, some 40 km north of Bangkok. The 23 buildings will be built over 16 months. In all, there are about 90 000 panels to be manufactured and erected at a rate of around 230 panels per day. This involved establishing a large precasting yard some 50 km from the site.

Westkon prepared the tender with Italian Thai, and provides it with technical support in the manufacture and erection of the precast panel building system.

Westkon is particularly proud to be associated with this prestigious Bangkok project. The on-site Westkon team is headed by George Cremasco. ■

ACN 051 987 181

ISSN 1037-9908

SURFACE FINISHES

This is the second article in a series dealing with finishes which can be provided to architectural and, in some instances, structural precast elements where those elements may have visual exposure.

This issue deals with:

i) Finishes directly off the form or mould.
ii) Exposed aggregate finishes using the water-washing technique and where the treated face is cast, face-up in the mould.

GENERAL

As discussed in the first article, the preparation of samples, possibly commencing with 300 x 300 samples to provide a general assessment of suitability may, where the project justifies it, be followed by a prototype panel/s to fully assess the choice of materials and method of production. Additionally, the following issues may be resolved:

- connection details
- jointing techniques
- any repair techniques likely to be used
- adequacy of surface coatings or sealers if used.

A variety of finishes may be produced directly off the mould. They include:

a) **Plain, flat and smooth finishes** in which the colour of the cement and the face of the mould predominate.

In practice, most such smooth finishes are intended to receive paint/coatings. In such applications, some of the criteria discussed below may be relaxed eg requirements for colour uniformity. Matt paint finishes give superior appearance and are preferred to gloss or semi-gloss.

Flatness of surface plane is a critical requirement. However, since panels are generally cast face-down in steel moulds, any flatness criteria is generally assured.

Since the mould face is generally flat, steel sheet and there is no additional tooling or treatment to the panel face after stripping from the mould, this finish at first glance may appear as a low cost finish. This, however, is not necessarily so; the high degree of care required to produce a face free of minor defects such as blowholes and achieving a reasonable level of colour uniformity whilst preventing blotchiness of the face may outweigh the costs of some tooled finishes.

If it is necessary to cast the panels vertically then the level of care necessarily increases.

PHOTOGRAPH 1 SMOOTH, RIBBED FINISH USING AN OFF-WHITE CEMENT.

In relation to some structural members such as bridge girders/beams having a relatively thin wall section, yet enclosing high levels of prestress and reinforcement, heed should be taken of the comments expressed in AS 3610 *Formwork for Concrete* and AS 3610.2 – Commentary.

With smooth finishes the cement colour will dominate the face colour with the fine aggregate (sand) providing a minimal influence. Note that the sand colour becomes more noticeable when a surface is tooled ie. sandblasted or acid etched.

Coarse aggregate colour will have no impact unless heavy vibration of the concrete induces the phenomenon of aggregate transparency in which instance the coarse aggregate presence is visible in a hazy, shaded appearance.

It should be noted that grey Portland cements are more likely to provide blotchiness and discolouration than off-white or white cements.

Moulds must be designed to ensure against any leakage whatsoever. Wherever possible, tapers should be built in so that the mould can be permanently sealed. After each casting, careful cleaning will be necessary, followed by regular burnishing with steel wool (assuming a steel mould). A very thin coating of mould oil, usually sprayed on and then wiped off with clean rags, will ensure high quality castings from steel and ply moulds.

Smooth off-form units may be expected to have some minor surface imperfections. Joints in steel plates, minor variations in the surface texture of a steel casting table and voids caused by entrapped air may be visible on this finish. As with all other finishes, a sample programme should be undertaken before casting commences to ensure that the designer/specifier is aware of the surface finish that will be finally achieved.

Smooth off-form units produced with high cement content mixes may exhibit some surface crazing after curing. This is a surface defect which is usually only visible when viewed at very close quarters or with some magnification. With prolonged exposure to the atmosphere, particularly in polluted environments, these very fine cracks may attract dirt and so appear more obvious.

Such crazing has no impact on durability or strength of the element.

Uniformity of manufacturing procedures is critical in the production of smooth, off-form finishes. Procedures that ensure consistent techniques for cleaning the mould, application of mould oil, uniformity of concrete quality, consistent curing processes and careful storage procedures will all contribute to produce a quality off-form product.

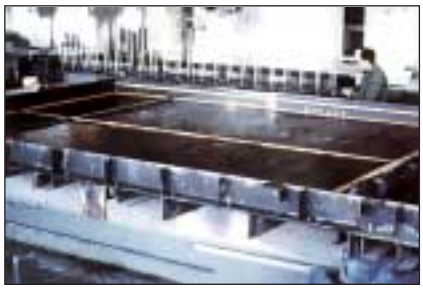
Handling procedures should be designed to minimise chipping and other damage. A smooth off-form finish is unquestionably the most difficult of all precast finishes to repair.

Chamfers to edges of panels are strongly recommended.

It is recommended that wherever possible, off-form surfaces should be modulated by grooving, sculpturing or profiling. Such techniques improve appearance by developing light and shade. This, in turn, will minimise any minor discolouration problems and provide improved, in-service weathering.

b) **Profiled or sculptured finishes, directly off the form or mould.** Such finishes can be achieved using a variety of materials incorporated into the mould face offering a multitude of patterns and configurations.

Some possibilities include steel, timber or plastic battens attached to the mould face, designed to transfer their shape into the face of the concrete. Triangular, semi-circular or trapezoidal shapes are used, noting the need to provide sufficient taper to facilitate stripping. A taper of 1:4 is generally adequate.



PHOTOGRAPH 2 PLACING TIMBER FILLETS IN MOULD FACE TO ACHIEVE 'DUMMY' JOINTS.

Elastomeric mould liners are commercially available offering a wide range of patterns. Whilst initially costly, these liners offer exceptional re-use.

When considering materials for mould linings, consideration should be given to the effect on those materials of steam curing the concrete.

Materials such as expanded polystyrene allow for significant detail but have very limited re-use capacity. Fibreglass offers in the order of 10 to 20 re-uses but requires a 'positive' mould onto which the fibreglass liner can be moulded.

Many of these initially off the mould finishes lend themselves to further treatment, generally some form of tooling. An example is the ribbed or fluted finish.

The arrises of the ribs may be hammered, striking the rib edge alternately left and right to provide a broken appearance in which the coarse aggregate is visible.

Whilst providing a pleasing effect, it is critical to require a full scale trial, to allow a mix design which will provide the required aggregate grading and colour. Further, the cost of tooling should be borne in mind since it is labour intensive. Additionally, the shape and depth of the ribs will significantly affect the appearance.

Photograph 4 illustrates a 'hammered nib' finish using timber battens (Figure 1) to produce a deep profile, whilst photograph 5 shows the very significant difference in appearance obtained by using a 'flatter' profiled metal sheet (Figure 2). Following hammering the nib becomes 'rounded' in profile and the valleys between ribs much more dominant.

b) **Water washed exposed aggregate.** This finish is both visually pleasing and economical. Additionally, it weathers well in service; this is due to:

i) the surface exhibits a high proportion of dense stone with very low absorption characteristics
ii) rainwater tends to drop off the points of the exposed aggregate, often being blown back onto the wall surface at a lower point. Thus, rainwater tends to become distributed over a large area of the face of the structure providing a more uniform weathering.

A dense, decorative, rounded or crushed stone should be selected. These may include natural river gravels, crushed river gravel or crushed rock such as granite of which there is a wide range of colours.

Aggregates should be selected for their decorative nature (colour) and shape. Rounded or cubical shapes are preferred since elongated or flakey shaped material

PHOTOGRAPH 3 USE OF AN ELASTOMERIC FORM-LINER. A VERY EXTENSIVE RANGE OF PATTERNS IS AVAILABLE.

PHOTOGRAPH 4

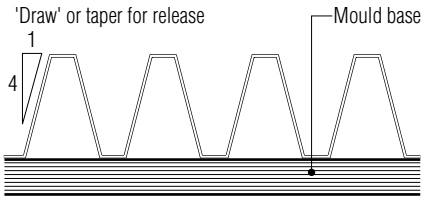


FIGURE 1

PHOTOGRAPH 5

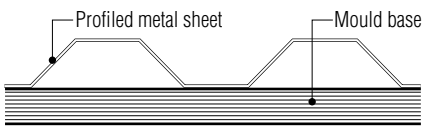


FIGURE 2

will not provide uniform appearance and may move (rotate) during washing.

Generally, a gap-graded mix is preferred since the washing process will remove much of the smaller sized material from a fully graded mix, reducing the density of the stone at the surface and hence the consistency of the finished appearance.

Aggregate size will depend upon a number of considerations, the most critical being:

- The amount of exposure required by the designer. As a general rule, it is normal to ensure that about two-thirds of the stone dimension remains bedded in the matrix of the mix.
- The larger the aggregate, the greater the depth of matrix to be removed. This removal of matrix if significant, becomes a loss of cover to reinforcement which needs to be considered when determining the thickness of the element.
- Aggregate Size v Viewing Distance

Size (mm)	**Distance** (m)
6–12	5–6
12–20	12–15
20–25	20–25
25–35	25–30
35–50	35–40

- Aggregate size should be compatible with the dimensional area to be exposed. The larger the aggregate, the more difficult it will become to accommodate returns, reveals etc.
  It is good practice to blend the matrix, using cement/sand colours and possibly a colouring oxide to approximate the matrix colour to that of the exposed stone. Such treatment will counter any minor variation in aggregate distribution.

PHOTOGRAPH 6 THE NEAR PRISTINE APPEARANCE OF WATER-WASHED FACADE, NOW AROUND 20 YEARS OF AGE.

PHOTOGRAPH 7 VARIOUS APPEARANCES OF EXPOSURE. THIS RANGE CAN BE FURTHER EXTENDED USING DIFFERENT SIZED AGGREGATES.

Whilst ideally suited to flat panels, cast horizontally with the ultimately exposed face uppermost, this method of finish can be applied to panels incorporating window openings.

When elements incorporating a return face are required, it is unrealistic to expect that the horizontally cast and water-washed face will be completely compatible with the return face which will have been cast vertically.

The vertical face may be retarded and water washed or washed without retardation. The latter approach is achieved by sliding-off the mould face in order not to create suction at the surface, after initial set has occurred.

Following exposure of the aggregate, and curing of the panel, it is normal to wash down the exposed face using a maximum 10% solution of muriatic acid. This treatment removes trace of cement paste and laitence etc which adheres to the face of the stone particles diminishing their colour and brilliance.

Subsequently, the surface is well rinsed with water to remove any residual acid solution.

Exposed aggregate finishes, cast face-up and water washed are economical, visually pleasing and provide an excellent weathering finish. Designers and specifiers can further utilise this finish in conjunction with other finishes such as smooth off-form and sand-blasted.

The next issue of *National Precaster* will comment on:

- exposed aggregate by chemical retardation
- exposed aggregate – face down casting using sand-embedment technique
- exposed aggregate sand/grit/hip water blasting. ■

PHOTOGRAPH 8 WASHING OPERATION. IN THIS INSTANCE, APPLIED TO HOLLOW CORE PLANKS.

PRECAST FLOORS

Before selecting any building material or construction process, the design and construction team must examine a range of techniques and materials generally accepting a solution which will eliminate, or at least minimise, the factors which may otherwise induce risk and often, cost into the project.

Developments in the precast concrete flooring market have seen a number of systems become available in Australia; all provide the advantages inherent in precast concrete construction; which in turn ***demands that the design and construction team thoroughly examine the product characteristics when making their choice of materials.***

Fundamentally, the issue of cost will predominate, but gone are the days when cost of materials was the sole concern. The realisation that, simplicity of construction, time to completion; issues such as minimising site activities and thereby reducing noise and site pollution, improving the quality of living by attention to issues such as limiting noise transmission between dwellings have now begun to receive the attention that they so thoroughly deserve.

Looked at individually, the ADVANTAGES of precast concrete include:

- Off-site manufacture of the flooring system. Manufacture can occur parallel to site establishment, earthworks and footings.
- The near elimination of formwork, propping and on-site steel-fixing minimising on-site labour and the impedance of following trades.
- Delivery to site to the contractor's requirements. No site storage required.
- Fixed cost.
- Rapid placement rates of 1000 m^2/day are common. This in turn can result in early completion of the project, giving an early return on investment.
- Rapid closure of the structure allowing early follow-up by finishing trades at the under-level.
- Safe working and storage platform created at the upper level. After the crane has placed the floor panels it is common for it to then lift brick/block palettes to the working level before leaving the site.
- The precast panels are generally cast on smooth, level beds or moulds ensuring that the underside of the panel which becomes the soffit or ceiling is itself smooth and capable of receiving decoration direct. Alternatively, simple suspended ceiling systems are available.
- Reduced site labour component with the workforce operating in a factory environment far more congenial than a building site.
- Inclement weather problems measurably eliminated.
- Flexibility in the siting of non-loadbearing partition walls.
- Site environmental issues massively reduced particularly noise and clean-up requirements.
- Ongoing marketing advantages including:
  - Significant noise reduction between floors and occupancies so essential in medium density construction. Whilst authorities generally call for an STC (Sound Transmission Class) of 45, precast flooring elements can easily achieve STC ratings of 45–59. (The larger the STC value the greater is the sound insulation).
  - Excellent resistance to fire.
  - The concrete floor, given advantageous orientation can provide most useful passive solar energy properties.
- Finally, in respect of advantages, it should be noted that mainstream precast concrete suppliers all have third party Quality Assurance. Apart from the peace of mind that such Quality Assurance offers, it further eliminates the need for on-site inspection, necessary when insitu construction occurs.

These advantages add up to a very powerful reason to investigate the use of precast concrete on your next project. They can be summarised as –

The Minimisation of Risk.

PRECAST CONCRETE FLOOR METHODS

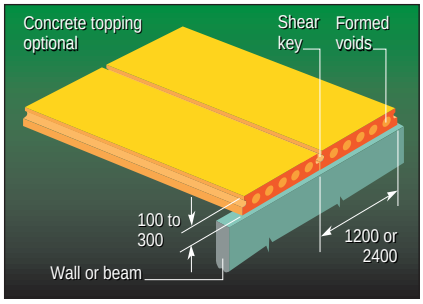
There are a number of precast concrete floor methods and suppliers, but availability varies throughout Australia. Contact the National Precast Concrete Association if in doubt regarding availability.

Further, it should be noted that the transporting of floor elements over a distance is not necessarily prohibitive since floor panels are generally flat sections and numerous panels can be transported in a single load.

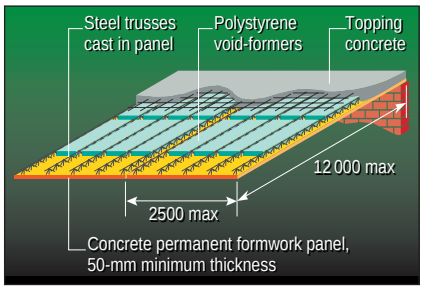
Discuss the issue of distance and cost with the supplier rather than simply dismiss it. The planning team and later the site management must give consideration to access for both crane and delivery vehicle. This may have an effect upon the delivery programme, construction sequence, the site layout of storage areas, site offices etc.

Articles in following editions of this Digest will discuss the proprietary flooring units available. These include:

Hollow Core Panels: a prestressed extruded panel in a variety of thicknesses to suit spans, loads etc.

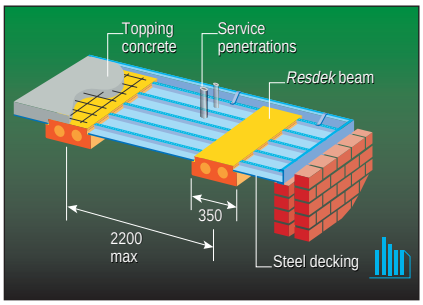


Transfloor/Humeslab, a wet-cast panel with included bottom reinforcement. Typically 50 mm thick, the panel acts as permanent formwork.

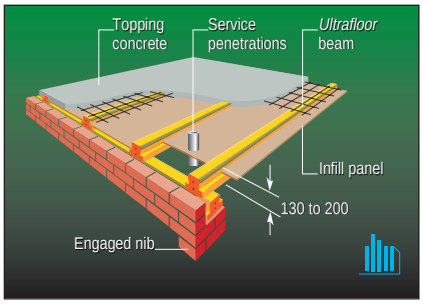


Get the PRECAST Advantage

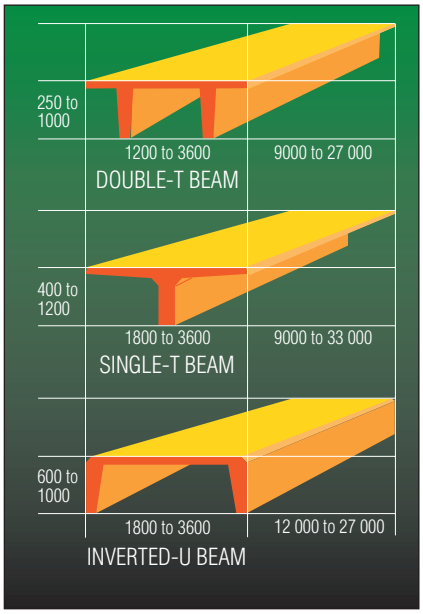
Resdek, a beam and infill arrangement. Uses a prestressed beam with 'Bondek' infill panels.



Ultrafloor, a beam and infill system having prestressed bearers and joists and cementitious board, infill panel.



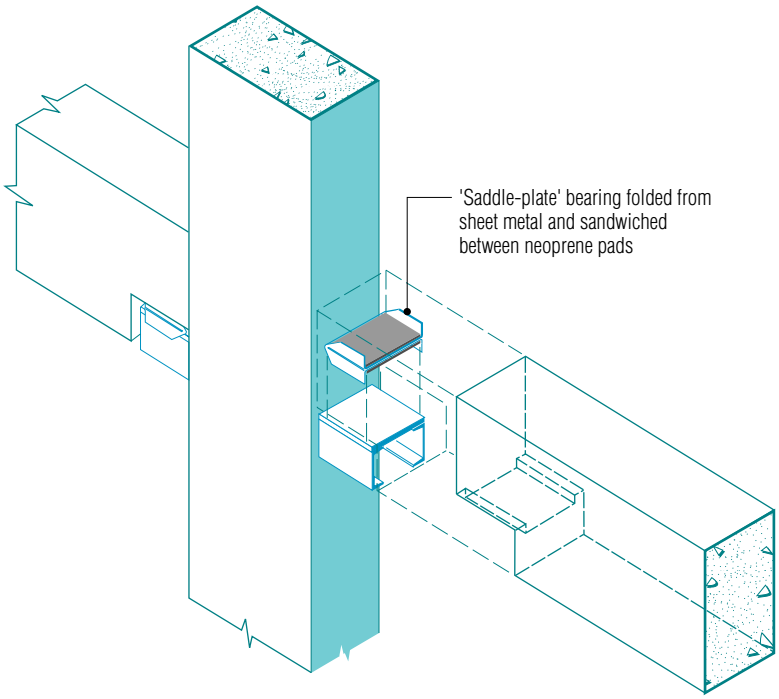
Single/Double Tee units. Suited to large uninterrupted spans.



TYPICAL DETAIL

BEAM TO COLUMN CONNECTION WITH BUILT-UP STEEL CORBEL

- *Built-up steel corbel is built into the column and consists of two vertically-orientated channels with welded horizontal bearing plates outside the column*
- *Beams have notched ends, giving flat soffits (no visual corbel)*
- *For simply-supported beams, this connection can transmit large vertical shear forces*
- *Additional ties or stirrups in the column should be placed above and below the corbel to counter any splitting forces*
- *The notched beam ends must be reinforced against the vertical shear force as well as torsion if the beam is eccentrically-loaded*
- *The corbel must be protected against corrosion and fire*



COMPUTER PROGRAM AVAILABLE

PCP4

is a program designed to massively reduce the design chore.

The program addresses:

- exposure classification
- creep and shrinkage values
- concrete cover for durability and fire requirements
- bending moment and shear forces
- 124 other values, relevant to precast hollow core floor panel design.

'PCP4'* performs the calculations and allows you to select the appropriate plank from your local manufacturer's product ranges.

This program is available from the program author. Contact 'Engineers Compendium' on (048) 62 1295.

** Requires IBM or compatible 486 or better PC with 8MB Ram, VGA Colour, Windows 3.1 or later.*

NEW PRECASTER IN SYDNEY

Girotto Precast Pty Ltd established in Dandenong Victoria, have now opened a precast concrete manufacturing facility in Sydney. The list of services provided by the company includes:

- 'In-house' detailing
- Casting using tilt frames
- Under-roof storage for up to 300 panels
- Capacity to produce 30 elements per day
- Transportation to site and erection including site welding, joint sealing and grouting.

The company is located at:
13 Whyalla Place Hoxton Park NSW 2171
Phone 02 9608 5100 ■

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.

OFF-THE-SHELF OR A MATTER OF DAYS

In the previous issue (No. 15) of *National Precaster*, the article entitled 'Getting the Most Out of Precast' discussed the issue of lead-times necessary for the manufacture of precast items.

The article tended to reflect upon customised precast products. In doing so, it neglected to remind clients that partly customised elements such as Hollow Core wall and floor panels could be on site within a few days of the manufacturer's receipt of the cutting list for panel length requirements.

Further, mention should be made that other precast products of a Standard nature such as drainage items, such items can be invariably supplied ex-stock. ■

Published by National Precast Concrete Association Australia PO Box 774 Warners Bay NSW 2282 Australia • **Tel/Fax 02 4942 7210**

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