

# NATIONAL PRECASTER

NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA



NPCAA

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## WELCOME TO

Ballarat Vibrated Concrete Industries  
 and Sunstate Cement Ltd as Members  
 of the National Precast Concrete  
 Association Australia

## COLOUR CONTROL OF CONCRETE

The term *colour control* refers to the need on many architectural projects to maintain consistent colour uniformity within an agreed range. Note the word *uniformity*. It is not usually the actual colour achieved which causes such concern, but the variation of colour either within a panel or between discrete panels. The difference between the client's or architect's expectation for colour uniformity and the limits physically achievable are occasionally cause for distress.

The real issue is:

'How Much?' not 'Whether'.

There will invariably be some colour difference between otherwise *identical* precast units. The degree of difference is the issue at stake and some of the following comments may help keep these differences to acceptable limits.

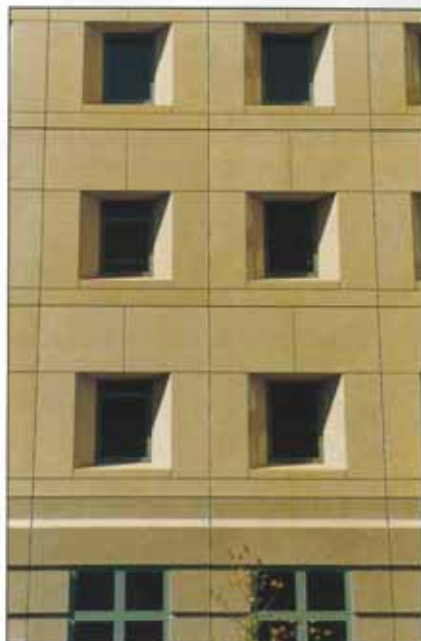
### 1 Factors within the manufacturer's control

Essentially, bad practices involving things such as a change of cement brand or a change to the mix design.

Fortunately, the industry now benefits from the presence of a stable group of precasters all having acquired significant expertise, benefiting from the improved design, materials and manufacturing technology of the past two decades. Additionally, all mainstream manufacturers comply with AS 3901 and 3902 Quality Assurance standards.

### 2 Factors outside the precaster's control

- Changes in cement colour, more likely to be associated with grey cements rather than off-white or white which are manufactured to very close colour tolerances.



GOOD COLOUR CONTROL, A POLISHED RECONSTRUCTED GRANITE AT THE LOWER LEVEL WITH SANDBLASTED FINISH ABOVE.

- Colour of aggregates likewise can vary at source, the duration of the manufacturing period influencing this. It is generally not practical to stockpile aggregates for an entire project although with some finishes such as acid etching and light sandblasting, it is desirable.
- Changes in curing conditions. Variations can occur as a result of changes in ambient temperature and humidity.
- Variations in pouring and finishing procedures due to normal human factors. Whilst improved training and understanding exists, a change of operator or even the varying performance of one operator may, for example, affect the degree of vibration or the depth of aggregate exposure in certain finishing techniques and hence, without affecting structural adequacy, will affect ultimate colour. Expectations of perfection are akin to expectations of a *perfect* round of golf, likely to lead to disappointment.



SKILFUL USE OF MIXED FINISHES, IN THIS INSTANCE A SANDBLASTED FINISH WITH OFF-FORM SCROLL AND WINDOW REBATES.

- Variation between horizontal and vertically cast units. This can be largely resolved by the designer not seeking to have such units adjacent to each other.

### 3 What to do about it

Perhaps the most important issue is to recognise and appreciate the variations which must be expected and determine the level of acceptability. Approaches here include:

- looking closely at existing buildings with similar mixes and finishes;
- talking to the precaster at the conceptual stage of the design.

### 4 Some rules

- Look at the use of the light grey tones of cement or even better, off-white or white whilst recognising the cost penalty of the last.
- When specifying aggregate exposure (sandblasting, etc), specify exposure to a depth of one-third to one-half of the aggregate size.



35-m-SPAN, TYPE 4 GIRDETS EXHIBITING THE BEST COLOUR CONTROL LIKELY TO BE OBTAINED ON SUCH LARGE MEMBERS.

- Try to avoid large areas of continuous flat panels. Ribs, grooves, etc massively minimise colour differences. Alternatively, look at using a variety of finishes, ie polished and sandblasted plus, maybe, limited off-form. (left)
- Try to avoid placing horizontally cast and vertically cast units adjacent to each other irrespective of the type of finish specified.
- Colouring oxides are now widely used, particularly in polished work. Where oxides are specified with off-form or tooled finishes (sandblasted, etc) use with care. At least, use only mainstream precasters and insist upon using only quality oxides.

Precast concrete, by the nature of the expertise available, the control over manufacture and the method of manufacture (ie most architectural panels are cast horizontally which eases placement, vibration and minimises bleeding) will almost invariably meet realistic standards of colour control.

### 5 Non-architectural work

Be realistic when considering colour control for non-architectural units such as large structural elements, eg bridge beams and similar structural units. Such elements, by the very nature of their design and manufacturing technology (need for continuous casting to avoid cold-joints, usually, very high reinforcement content combined with significant vibration) do not sit comfortably with a colour control specification. AS 3610 allows for specifying levels of colour control where Classes 1, 2 and 3 surface finish are required. However, recognising the issues discussed above, when Class 2 or 3 surface finishes are specified for large structural elements, it is not appropriate to specify tight colour control.

Specification of colour control for general, structural, precast elements should be avoided.

## MEMBER PROFILE



SYDNEY AIRPORT RADAR TOWER: PLACING THE FINAL SEGMENT, PRECAST DECK STILL TO BE LIFTED.

Structural Concrete Industries (Aust) Pty Ltd was founded in 1979 and has become a leading designer and manufacturer of precast and prestressed concrete components for the civil and building construction industries.

Specialising particularly in structural elements for bridges and buildings, SCI has earned a reputation in the construction industry for developing innovative solutions to special situations which arise in construction. SCI has particular expertise in the manufacture of very large and heavy precast components, with typical component lengths of 35 m with masses of 65 tonnes being produced.

Structural Concrete Industries has its factory at Teralba on Lake Macquarie, adjacent to the Newcastle Expressway and just some one and a half hours north of Sydney. The design, sales and advisory function of the company is located at its office in the Sydney suburb of Turramurra.

Typical of the range of units manufactured by SCI are bridge components including a complete range of girders, planks and piles together with columns, beams and high-quality, off-form-finish componentry for buildings, grandstands and pedestrian bridges.

A recent major project was the design and construction of the Eugene Goosens



ABC STUDIOS SYDNEY: ERECTION OF THE EUGENE GOOSSENS RECORDING HALL (A DOUBLE-SKIN WALL AND ROOF ARRANGEMENT USING SINGLE TEE UNITS), INNER ROOF BEING PLACED ON INNER WALL SKIN.

Rehearsal Hall for the new ABC Headquarters at Ultimo where very large wall and roof units were used to create the fully precast double-walled soundproof performing and recording facility.

Other major projects include the new radar and control towers at Sydney's Kingsford Smith Airport. These tall precast structures incorporate very-high-quality, off-form, off-white concrete finishes.

The recently completed extensions to Macquarie Shopping Centre at North Ryde made extensive use of massive precast columns, beams and fire tunnel components.

Major civil works include bridges on the F3 Freeway and the M4 and M5 motorways. Numerous bridge superstructures for the Cityrail network have also been completed over the past few years and most recently 16 superstructures were supplied to the National Rail Corporation for bridges on the North Coast line.

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**MANAGEMENT**

Godfrey Smith, Managing Director  
Wolfgang Merretz, Technical Director

**PRODUCTS**

Structural – Prestressed and reinforced girders, beams, columns, frames, sea walls, piles, pedestrian bridges, grandstand and carpark units.

Architectural – Off-form cladding panels and specialised structures.

Drainage – Box Culverts.



The precast concrete industry can provide a wide range of earth- and materials-retaining structures, varying from relatively small, essentially hand-placed units to elements of several tonnes mass, requiring placement by crane. Yet each has quite specific characteristics which may make the unit the most suitable choice for a particular project. Some of the systems available are discussed below:



■ DOUBLEWALL CONSTRUCTION IN PROGRESS

■ **Doublewall** is a recent introduction to the Australian market; it features a mass gravity retaining wall comprising a series of concrete modules placed atop each other and the void filled with a free-draining earth. This fill increases the wall stability by increasing the wall mass.

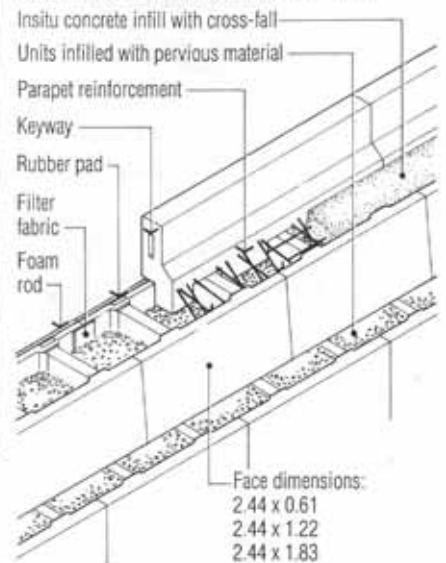


FIGURE 1 DOUBLEWALL ISOMETRIC VIEW

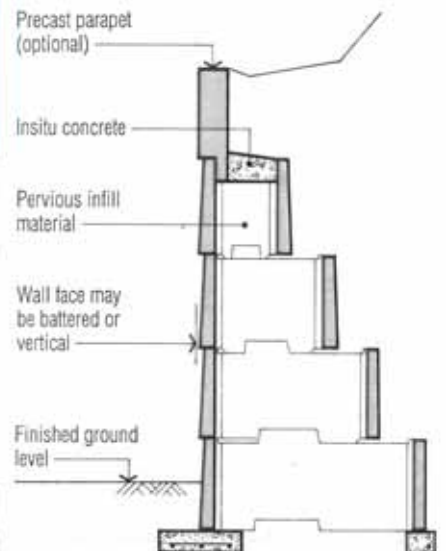


FIGURE 2 DOUBLEWALL TYPICAL SECTION

The modules have a face dimension of 2.44 x 1.22 m with depth (front to rear) varying from 1.2 to 6.1 m providing for wall heights up to 12 m. Wall configuration may be battered or vertical and the design permits for 'on-plan' directional change either by chords or by large-radius curve.

A recent project by Queensland Rail required an earth-retaining wall some 160 m long and 4.6 m high on a section of line from Buranda to Norman Park, being part of the new dual-gauge line from Dutton Park to Fisherman Island at the Port of Brisbane. The additional space for the rail corridor required the widening of an easement which then gave need for

the retention of an earth bank to adjacent road and housing.

A placing rate of 100–120 m<sup>2</sup>/day was achieved on a site restricted by configuration and train movements.

■ **Crib Walling.** The honeycomb nature of this construction form prevents the build-up of hydrostatic pressure behind the wall, and so eliminates one of the most common causes of retaining-wall failure. The small-scale nature of the units permits manual handling, while the simplicity and dimensional accuracy of the units provides for quick placement.

The earth-filled voids between the units allows for planting, satisfying aesthetic demands. In special applications such as the use of crib walling in a marine situation, a 'closed face unit' which replaces the front stretcher unit is available to prevent the wash out of fill material.

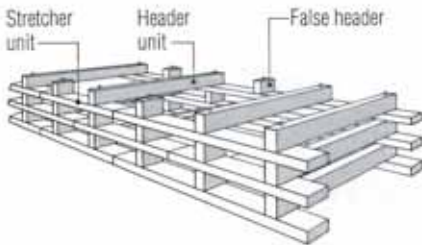


FIGURE 3 COMPONENTS AND ARRANGEMENT OF CRIB WALL

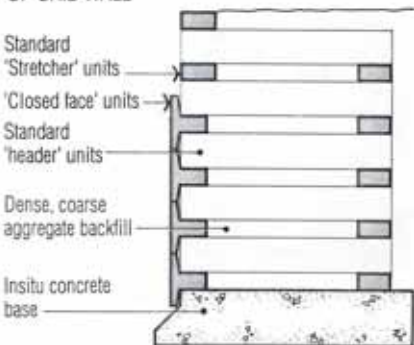


FIGURE 4 MARINE APPLICATION USING 'CLOSED-FACE' UNITS.

The crib wall arrangement is also available in 'mini' format, providing a scale more in keeping with domestic application and providing wall heights up to around 2.5 m.

Whilst crib systems can be constructed vertically but to limited height, a battered face of 1:4 is preferred. 'On-plan' curves of as little as a 10-m radius are feasible.

This article has briefly described just two of a number of earth-retaining arrangements available in precast concrete. Each is quite different from the other in terms of mass, dimensions, placing techniques and requirements for handling. These differences may serve to make either one a more suitable choice in a given set of circumstances.

# B BRIDGE DECKS

A recent development in the use of precast concrete permanent formwork arrangements marketed as *Transfloor* and *Humeslab* has been the use of the product as permanent formwork bridge decking. The formwork product, comprises a 55-mm-thick precast soffit slab incorporating required bottom reinforcement and partly embedded reinforcement trusses.

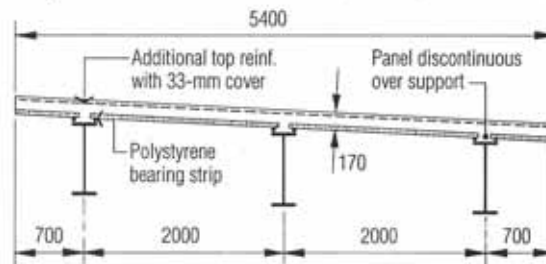
The permanent formwork decking becomes an integral part of the deck slab, acting compositely with the cast insitu slab.



CLOSE-UP SHOWING 55-mm-THICK PRECAST SOFFIT PANELS SUPPORTED ON STEEL (OR PRECAST) BEAM.

Note:

- built-in trusses in top of soffit panel
- additional top reinforcement
- high-density, expanded polypropylene strip providing uniform temporary support and sealing joint during insitu concrete placement.



SECTION A-A

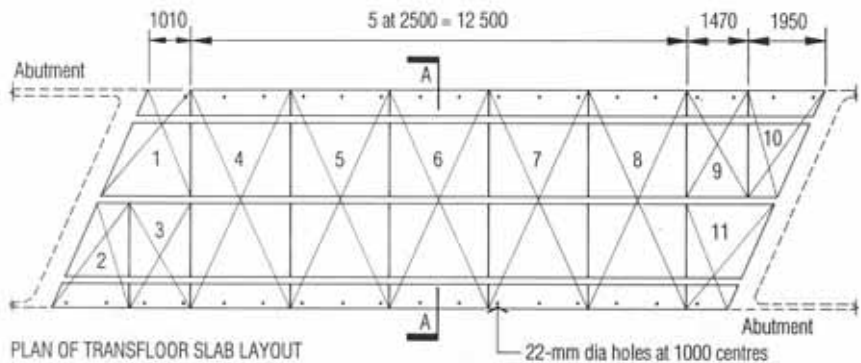


FIGURE 1 A RECENT VICTORIAN PROJECT. THE *TRANSFLOOR* PANELS WERE PLACED WITHIN TWO HOURS, ADDITIONAL TOP STEEL, EDGE FORMS, ETC COMPLETED AND THE INSITU DECK SLAB POURED THE FOLLOWING DAY.



■ CRIB WALL – EFFICIENT AND VISUALLY PLEASING

The ability to use the precast permanent formwork decking in a cantilever configuration beyond the outer beams provides a significant saving in direct cost and construction time plus offering a very real safe-working advantage.

No propping or formwork is required for the bridge deck, including the cantilever section, during construction. Edge forms for the insitu deck may be bolted to preformed holes in the precast permanent formwork panels, or the edge kerb upstand may be formed and poured simultaneously with the insitu deck. Alternatively, a precast fascia or spandrel may be tied into the insitu deck slab.

Since the panels are wet cast in steel moulds it is a simple operation to provide skew ends, a frequent requirement for bridge decks. Panel dimensions are usually restricted to around 12.5 m x 2.5 m to meet road transport requirements.

Victoria has witnessed a number of such projects in the Shires of Dundas, Glenelg and Narracan, whilst in NSW, the RTA has recently used this construction method for a new two-lane bridge over the Great Western Highway at Woodford in the Blue Mountains.

This latter project used two 44-m trough girders supporting *Transfloor* panels of lengths varying between 9 m and 11 m x 2.395 m in width. Panels were cast complete with edge kerbs and with reinforcement trusses and bottom reinforcement continuous. Using bulkheads, the concrete was discontinued at four points, these coinciding with the top flanges of the trough girders to which shear connectors were welded.



*TRANSFLOOR* PANELS AWAITING DELIVERY TO SITE (top) AND BEING LIFTED INTO PLACE.

The insitu deck pour then provided a composite deck/girder element and a sub-base for the road pavement.

The relative simplicity of construction provided the contractor with a quick, budget-conscious solution to a quite difficult construction problem.

# S STRUCTURES

We've all heard of temporary structures, but here's a different twist. Recently, on the east coast, use has been made of previously undeveloped sites to generate cash flow and provide certain amenities.

Prominent has been 'demountable' car parking stations, several of which have been erected over the past two years. They have been developed as:

- temporary revenue raisers on sites where no clear, long-term development can be determined due to a range of issues including financing or lack of clear commercial direction as to permanent development;
- short-term facility, possibly coupled with revenue raising where there is a long-term dedication of the land.

A number of these projects are briefly described; all feature a structural steel frame and precast concrete decks, the emphasis being on demountability. It should be noted that precast structural frames, although more-commonly associated with permanent structures, could have been used. The important issue here is to recognise the difference between *temporary* and *demountable*.

## 1 Thornleigh Railway Station

Here, as part of the Department of Transport's Commuter Facility Programme, a previously 'on-grade' site, dedicated to long-term further rail extension and providing parking for around 100 vehicles, has been replaced with a 300-car-space, multi-deck facility.

This is designed to encourage commuters to use rail facilities, driving only from home to rail centre. The steel frame and hollowcore precast concrete deck provides up to four elevated levels of car parking.



PLACING 1.2-m-WIDE HOLLOWCORE PANELS. NOTE USE OF PURPOSE-MADE LIFTING FORKS AND PERSONNEL SAFETY ARRANGEMENTS.

Courtesy of Civil and Civic

## 2 ANU, Canberra

Here, the choice of a similar steel frame, precast concrete deck and hollowcore spandrel panels was determined by the guaranteed speed of construction, the 360-bay structure being erected in some three months, less the Christmas holiday break, essentially in the University vacation.

## 3 Liverpool Hospital

This 600-car-space parking facility (with capacity for extension to 800) is again a steel frame with precast hollowcore floor panels and spandrels.

Here the choice of system is based entirely upon its demountable characteristic, it being envisaged that, in a major teaching hospital, the site may well eventually be required for hospital facilities. Construction time for the 600-space facility is some six months.



SIMPLE CLEATING ARRANGEMENT, HOLLOWCORE SPANDEL TO STRUCTURAL FRAME.



VIEW OF CONSTRUCTION IN PROGRESS. PANEL PLACEMENT RATES WERE IN THE ORDER OF 1000 m<sup>2</sup>/DAY.

## 4 St Francis Church, Melbourne

On a restricted site in the heart of Melbourne, this six-storey structure provides offices, etc at ground level, with 300 parking spaces at the upper levels. This project is fully enclosed, having all services, lifts, mechanical ventilation, etc and was completed in just six months.

Floor panel placing rates were in the order of 1000 m<sup>2</sup>/day. The project is intended to generate cash flow for the church authorities.

The simplicity of erection, the ease and speed of construction and ultimate demountability of all these projects typifies the versatility of precast construction. Following grouting of the plank shear key, joints are sealed using a silicone mastic. Planks are untopped.

# SAFETY



Safety in the workplace is an issue to which precast concrete manufacturers give much thought during product development.

Generally speaking, precast manufacturers deliver to site, while handling and erection of the product is performed by very skilled, specialist erectors. In some instances, the general contractor or, as in the plumbing and drainage industry, a specialist sub-contractor may elect to handle the precast product.

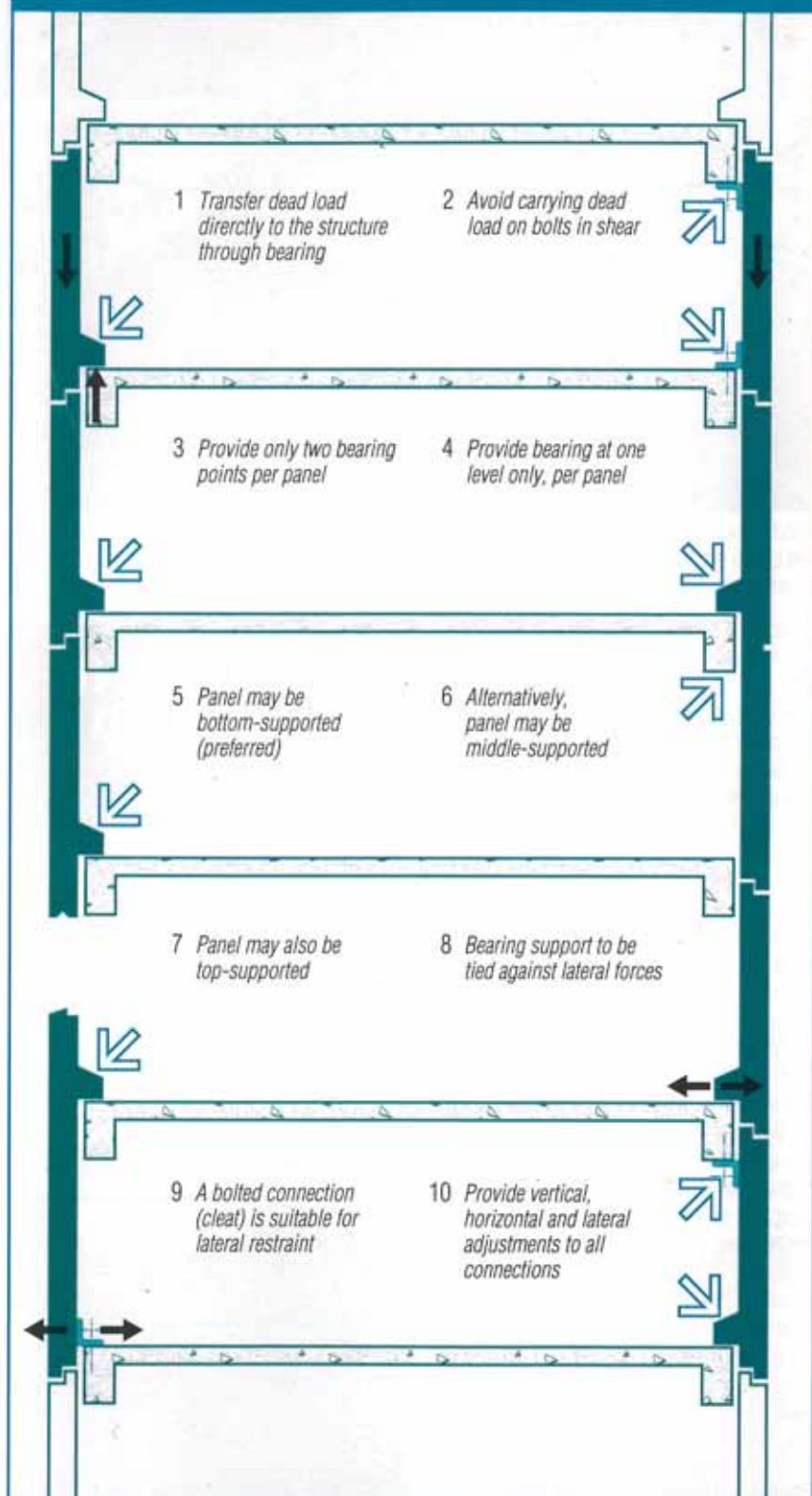
To assist in improving safety and ease of handling of drainage products, use has recently been made of the Reid *Swift-lift* fitting. These fittings are now being sought by many Authorities to be cast into a variety of precast drainage and sewerage products, including pipes.

The Reid anchors are cast in and attached by chains to the lifting device, providing a very safe lifting method whilst improving placement techniques.

According to Len Lulka, an engineer with Blacktown City Council, the efficiency in laying is improved by around 10%.

The introduction of new Health and Occupational Safety requirements has significantly increased the onus on manufacturers and employers to ensure a safe working environment. For this reason, the 'safe' pipe arrangement has attracted considerable interest from within the construction industry.

## TYPICAL DETAIL THIS ISSUE TEN RULES FOR CLADDING PANELS



### Quality Assurance Policy Statement

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

The information provided in this publication is of a general nature and should not be regarded as specific advice. Readers are cautioned to seek appropriate professional advice pertinent to the specific nature of their interest.



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