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NATIONAL PRECASTER

NATIONAL PRECAST CONCRETE ASSOCIATION AUSTRALIA

PRESIDENT'S COLUMN

IS PRECAST CONCRETE ENVIRONMENTALLY SOUND?

The community's emerging environmental consciousness is having an increasing impact on business - both internally through changes to our basic attitudes and from external sources through tougher legislation. The tests to which any product should be put, have to do with its usefulness and efficiency, the environmental impact of the manufacturing process and the demand made on finite or scarce raw materials.

For so long as the community demands buildings and structures, precast concrete will be an essential product – no other material can match its range of structural and aesthetic properties for elegant solutions in the design of projects from bridges to facades of monumental buildings such as Parliament House. The structural efficiency of prestressed concrete, the loadbearing capabilities of architectural facades and the long-term durability of high-quality precast are all examples of its usefulness and efficiency.

Precast factories are not amongst our potentially highly polluting industries. The risks come from alkalinity of waste water, dust and noise. Over the past 20 years or so water recycling systems have become standard in most factories, cement silos have been fitted with dust arresters, and the level of safety for employees has been improved greatly by the use of proper protective equipment. Factories are now beginning to install sludge removal equipment to cut the volume of liquid waste disposal, while recycling plants for processing waste concrete are probably not far from being in general use. Equally important is the fact that precasting moves a huge amount of noise, dust and other processes from construction sites ill equipped to deal with it, to specialised factories which are. Similarly, precast factories provide stable employment for people in the surrounding areas, thus saving much of the expensive travel of workers to a multitude of construction sites.

Precast concrete is increasingly being used as a replacement for high-quality timber in applications such as railway sleepers and power poles. In these uses concrete will normally have a much longer economic life than timber. Precast permanent formwork replaces plywood forms made from rainforest timber. The raw materials for concrete, while sometimes occurring in environmentally sensitive areas are relatively plentiful. The increased use of recycling of a variety of materials should provide a significant proportion of our fine and coarse aggregates in the years ahead.

Precast concrete undoubtedly passes the tests. It is environmentally sound and developments in manufacture and application will continue to improve this position.

JOHN BURKE

OUT OF SITE – OUT OF MIND

An article appearing recently in a construction industry magazine relating to the construction of Randwick Shopping Centre made this comment:

'It is of note, that due to ongoing construction activities in some areas, a number of large panels were cast off-site transported and erected so as not to impede progress.'

'We believe this to be a first for large tilt-up panels traditionally cast on-site'.

Putting aside the confusion of terminology provided by the statement, the message is loud and clear and attests to the desirability of limiting the amount of sitework with its attendant uncertainty and getting the work off-site and into the precast yard where quality production can proceed simultaneously with site establishment and preparation. Precast offers specific advantages to client, designer and head contractor.

PANELS FOR THE ANA HOTEL PROJECT STORED IN THE MANUFACTURERS YARD READY FOR DELIVERY.

Speed of construction is an obvious advantage of precast usage. Precast manufacturers normally schedule to produce units well in advance of the construction site requirements.

It should be noted that such logistical advantages do not occur randomly but result from careful forward planning and the early introduction of the precaster into the contract scene.

Speed of construction must go hand in hand with safety. This is exemplified by the use of elements such as precast floor systems capable of quickly offering a safe, working area capable of supporting construction loads up to design capacity and importantly, providing at the level below, a clear working area uncluttered by props and forms, permitting ready access by following trades. Systems offering these advantages include, Transfloor, Humeslab, Rescrete, Formplank, the range of Hollow Core floor elements, beam shells, single and double Tee beams.

Site-generated noise and dust can cause significant restraint on a construction programme within a municipal environment to a point where working hours will be dictated by the Local Authority. Precasting gets these problems away from the site allowing work to be performed in a duly designated 'industrial' location with built-in provision for waste collection and disposal.

LOADING A 21-TONNE, PRESTRESSED, 12-METRE COLUMN UNIT. THE RECONSTRUCTED GRANITE ELEMENT IS POLISHED ON ALL FOUR FACES.

CONFUSION AND DIFFICULTY PROVIDED BY TRADITIONAL TECHNIQUES.

FACTORY ENVIRONMENT OFFERING CONTROL OVER INCLEMENT WEATHER, NOISE, DUST AND WASTE POLLUTION.

SIMPLICITY, SAFETY AND SPEED PROVIDED BY THE PRECAST OPTION.

Product quality is enhanced by factory production, continually being improved to take advantage of developments in technology; control over inclement weather is afforded; the established nature of a factory operation where the workforce is largely permanent in nature provides for acquired expertise.

All precasters perform to a Quality Assurance standard; this together with the ability to inspect the product prior to delivery provides for effective acceptance controls.

All the foregoing comments apply equally to highly automated hollow core floor and wall units, through to structural elements, the most efficient drainage pit to the very aesthetically pleasing range of architectural cladding finishes.

The precast industry can produce an enormous range of products of shape, form, texture, colour and application. To maximise the benefits of precast, look for the simple solutions of major repetition, simplistic shapes and ease of handling and fixing.

This is not to say that the precast manufacturer resists the challenge of producing the unusual. The capacity of plastic state concrete to be moulded into quite complex shapes, the ability to introduce colour and texture coupled with the innovative nature of the precaster, in turn, provides the designer with a range of design possibilities rarely found in alternative materials. □

HONED AND POLISHED FINISHES

The precast concrete industry has a very significant capital investment in terms of land, buildings and equipment. Further, the industry has always been prepared to invest in equipment which can be demonstrated to improve the economy and quality of its products. The emergence of polished finishes is a case in point, with a number of NPCAA members having installed automated equipment to provide this finish to flat or curved (convex) surfaces and returns.

EARLY USE

The polishing of concrete to provide a surface resembling natural stone is not new, the technique having been used in Australia over the past thirty years. The product is often referred to as 'reconstructed granite', which results from granite aggregate being the most suitable for polishing. Early examples of this finish include St James Square, Melbourne and the recently demolished Commonwealth Centre, Sydney.

The term 'honed' refers to a level of grinding which produces a smooth but matt finish. Further grinding produces a polished finish.

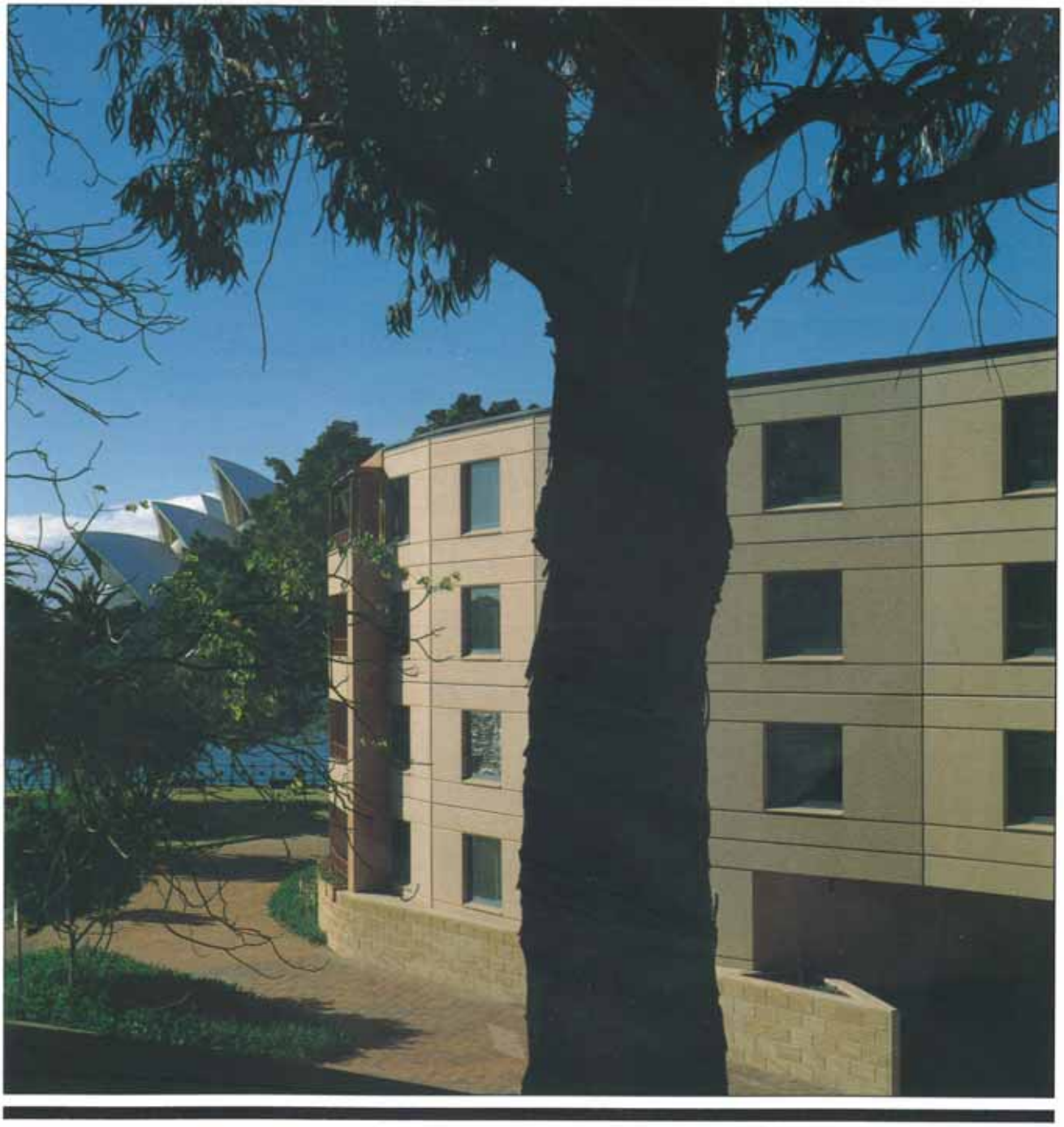
POLISHING

The polishing machine is essentially a beam travelling along tracks with a motor-driven grinding head traversing it. The movement of the head can be controlled longitudinally, laterally and vertically. In automated equipment this three-dimensional movement is directed by a programmed computer (see photograph right).

Carborundum or diamond abrasives are attached to the grinding head and rotate individually.

The cutting process uses a range of abrasive sizes; coarser abrasives or diamonds for the removal of material to expose the aggregate, finer abrasives to polish the aggregate. Small and awkward areas can be polished with hand-held equipment.

THE DELIGHTFUL APPEARANCE OF, IN THIS INSTANCE, A HONED FINISH.



POLISHING EDGE RETURN

ECONOMY

The rules for economy are straightforward: maximise machine work, reduce hand-work. This requires that polished surfaces should be large, flat and readily oriented beneath the polishing machine. Returns should not terminate in re-entrant corners. Reveals, false joints and awkward profiles, should ideally be left 'off-form', etched or sand blasted.

Panel shapes should be kept simple and generic to permit high mould re-use.

Where expensive aggregates are specified, often in association with more-expensive white cements, a technique referred to as 'veneering' may be used. The veneer of this more-expensive mix may be some 30 mm thick. It is important that the casting of the whole panel, ie veneer and backing, be completed as a continuous operation.

CONCRETE MIX

Aggregates for polished finishes are generally selected stone of a more-expensive nature. The mix should therefore be as close to the 'as-crushed' grading as finished appearance and good concrete technology will allow.

Where a high stone density is required, some experimentation with aggregate grading and cutting depth will be necessary. It is common practice to match the colour of the matrix with that of the coarse aggregate by using the crusher fines as the 'fines' (sand) content and by the use of colouring oxides. This tends to offset any incidental variation of aggregate density at the surface.

As with most precast work, a high cement content (450–550 kg/m^3) is typical of polished work, the early strength achieved providing good aggregate bond during grinding.

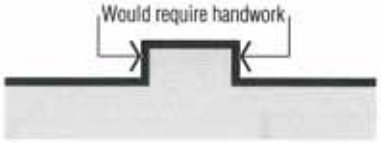
WEATHERING

The polished nature of the surface, combined with a high exposed, polished aggregate content provides for early shedding of water and dirt and minimal surface absorption. Thus a polished finish can be expected to remain clean and fresh in appearance and have excellent durability characteristics.

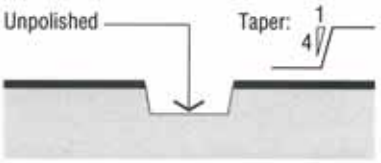
A light acid etching of the surface in the factory removes soluble alkalis ensuring that, where the work is exposed to alternative wetting and drying, any staining which these alkalis may otherwise produce is prevented.

FINAL CLEANING BEFORE DELIVERY

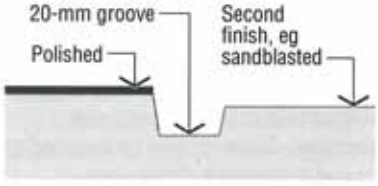
Some practical issues which the designer will need to consider include:



- Requires hand work if returns are to be polished.



- Suitable – groove not polished. Groove may be left off-form or sandblasted.
- Note need for taper or 'draw' to allow stripping from mould.
- Need for groove of adequate size, capable of being 'read' at a distance.
- Consider depth of groove in relation to cover to reinforcement.

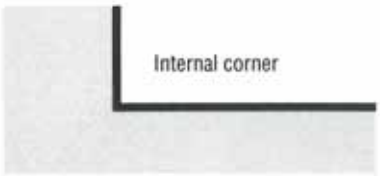


- Where more than one finish is required, the surface to be polished should be 'proud' of other surfaces.

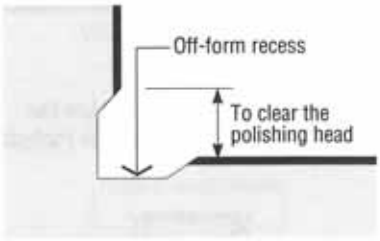
■ Avoid sharp edges in any precast panel to avoid site damage.

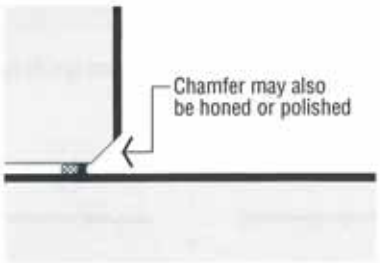
■ Use chamfer.

■ Convex surfaces suitable for polishing where radius is 3 m or more.



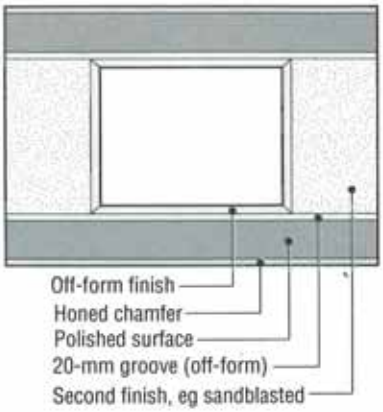
■ Obvious difficulty of polishing internal corner.





■ Consider unpolished recess or making two units.

■ Use chamfer at external corners. With square corner, polishing may cause minor fretting. Square, sharp edges are susceptible to handling and site damage. Chamfer may be polished or honed to maintain dimensions.



■ One of many possible panel treatments.

CONCLUSION

Polished finishes using selected aggregates, cement and possibly colouring oxides compare visually with natural stone but at a greatly reduced cost. Further, the ability to mould the panel into a range of profiles offers the architect great freedom of design expression. □

POLISHED, RECONSTRUCTED GRANITE USED FOR FLAT AND CURVED SPANDREL PANELS AND 900-mm DIAMETER COLUMNS, PROVIDING AN ELEGANT, DURABLE FACADE

SEEKING PERFECTION

C I and D Precast Pty Ltd have recently commissioned a new plant at Somersby, north of Sydney.

The company is best known for its wide range of drainage items whilst still providing general precast work. The extent of this range of specialist drainage products is generally not recognised, after all, we mostly bury the units below ground and accept, as a matter of fact, their usefulness. But, like all precast concrete, the significance of receiving onto site, quality, completed units requiring only placement and fixing, massively reduces uncertainty and cost on site.

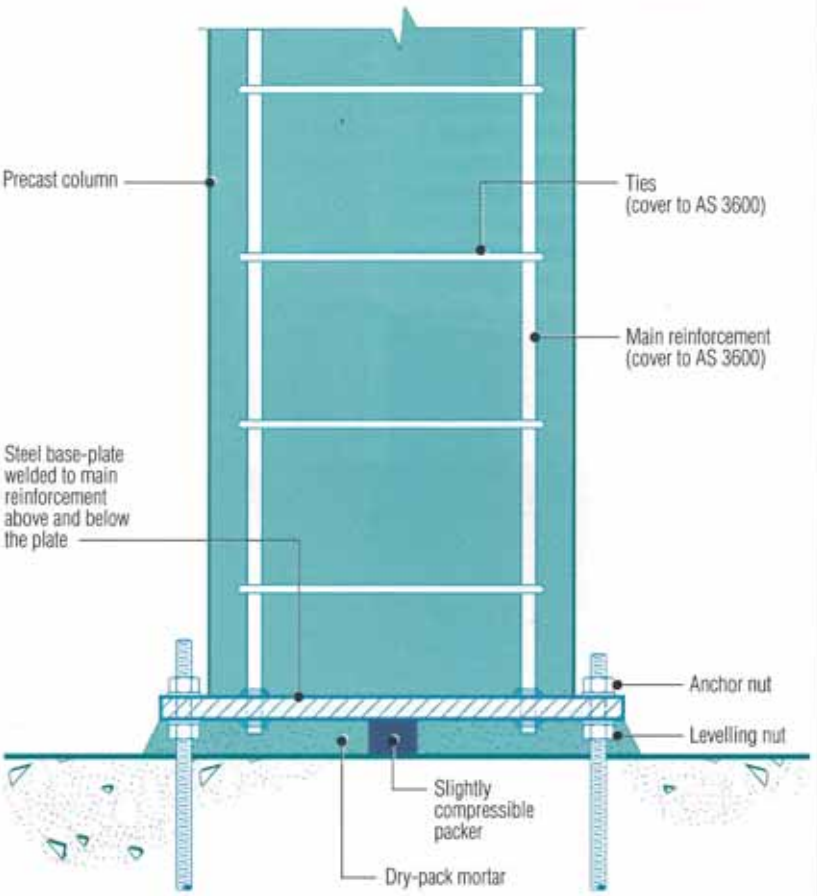
The semi-automated Somersby plant includes sophisticated computer-controlled batching arrangements, capable of providing a variety of mix designs to some half dozen work stations. Most of the company's drainage products use a very low-slump mix to minimise permeability of the product; the smooth, dense finish being achieved using high-capacity vibrators.

PART VIEW OF CASTING SHOP.

TYPICAL WORK STATION – MIXER DISCHARGES INTO HOPPER, CONCRETE IS THEN CONVEYED TO POINT OF CASTING ON A MOVING BELT.

TYPICAL DETAIL

THIS ISSUE: COLUMN TO FOOTING



BOLTED CONNECTION - COLUMN TO BASE

- *Requires care in setting-out*
- *Gives good moment transfer*
- *Dry-pack mortar requires care in placing, compacting and curing*
- *Bolts to be close to column but allow for tightening*
- *Gives early stability during erection*
- *Location of column is easier if one bolt is marginally higher*

MOULD, FILLED WITH ZERO-SLUMP CONCRETE MIX, BEING VIBRATED. FLOOR PIT HOUSES A 10-TONNE-CAPACITY EXTERNAL VIBRATOR TO WHICH THE MOULD IS ATTACHED.

Aggregates and cement are automatically weighed into an elevating skip which raises the materials to the mixer. From the mixer a delivery skip traverses the length of the casting shop to serve all the work stations.

With present-day requirements for dust suppression and control over waste disposal, CI and D have spent some $170 000 to ensure they remain within the guidelines and requirements of the SPCC. All surface run-off and waste is treated in a series of traps and settling tanks prior to discharge of the treated water. □

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