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TIPS

CEMENT CONCRETE
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Leading Knowledge-Sharing Information

Prising-Open Precast Panels

St Margaret's Maternity Hospital Redevelopment,

As a young architect working in the NSW Government Architect's Office in 1955, Ken Woolley designed the chapel for St Margaret's Maternity Hospital. The circular plan form was developed using 36 full-height precast panels, which were placed alternatively backward and forth, like the staves of a wooden drum. The slot openings between the panels were glazed with glass blocks, allowing diffuse light to wash over the inside smooth-finished concrete walls. Woolley's design, which translated a modernist type into an intimate space for contemplation, was achieved using a conventional precast system articulated by intervals of light.

Fifty years on, PTW + SJB Architects have been commissioned to develop the site for medium-density residential and commercial use. The chapel is retained, adapted for use as a gallery and engaged as a key component in a new site configuration. At the micro-level, Woolley's precast design, which systematically prises-open a vertical precast joint, provided a material reference point for the design of a new structure.

Building 2 or 'Henry', is a reinforced slab building comprising 14 two-level apartments over ground floor retail. The building is eighty metres long and located on the west site boundary between Crown Street Primary School and a

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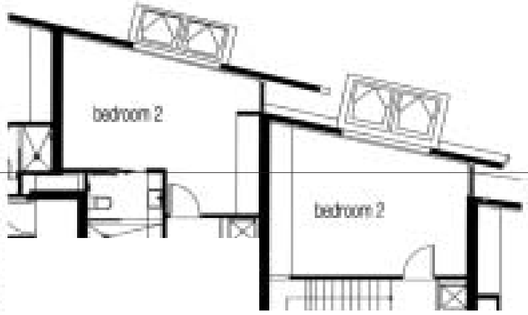
Surry Hills NSW

Part plan of Building 2 showing the staggered precast walls to the upper level bedrooms



new internal plaza. Within the context of an inner city site, concrete construction provided an appropriate level of acoustic and physical robustness for a low-rise residential building.

Like the chapel, the stepped facade functions to provide vertical openings to the building interior, but in this case, serves to break-up the building mass into smaller planar components.

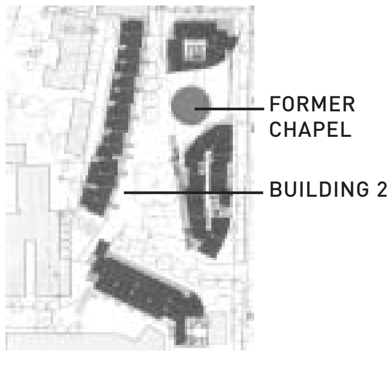
The design uses full-height sloping precast wall panels to articulate the length of the building as a domino-like series of inter-sleeving boxes. The building responds quite differently to either end of the site due to the changing slope of the wall planes, and stacks up like a thick accordion wall to the street, studded by triangular pop-out skylights.

Each identifiable full-height section of wall comprises three precast panels which are fixed to the insitu concrete floor slabs. Combined with incremental variations in the angle of the panels, a series of non-rectilinear openings are created which provide a degree of privacy and outlook for the individual apartments.

The panels were designed using Botany sand and off-white cement to a Class 2 off-form finish which is exposed externally and rendered internally. A series of irregular linear grooves were cast into the external face of the panels using V-shaped timber dowels which were screw-fixed to the metal pouring beds. The resultant supergraphic is crisp, legible at an urban scale, and acts to reconnect the whole.

The innovative use of vertical jointing in precast construction, has provided a sound resource to articulate a long-panelled wall which has an 'easy fit' to the nineteenth century row terraces which surround it.

ARCHITECT: PTW+SJB Architects
COMPLETION: October 2004
STRUCTURAL CONSULTANT: Meinhardt
BUILDER: Grocon
CONCRETOR: Advanced Precast
(02 9756 5631)
ARTICLE: Kylie Fitt (SJB Architects)
PHOTOGRAPHY: Kylie Fitt, Adam Haddow, Jenny Baxter, Jordan Curran
1958 IMAGE SOURCE: Monument 31



Single Room Extension in Thornbury

Concrete Lean-To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This project is a small extension to a two-storey brick house, which was originally constructed in the 1960s and has subsequently undergone a series of large-scale additions and alterations. The design incorporates two interlocking circular forms as a single space, located between oblique concrete wing walls which form part of an earlier extension by architect Kevin Borland.

The addition provides the existing house with a small north-facing sitting and meals room which projects out into the garden. It is fully-glazed and is shaded by a stand of mature poplar trees. Concrete construction was selected to provide simplicity of form and structure, considered and articulated as a separate element to a surrounding glazed 'curtain'.

Five concrete columns support a 250-mm thick concrete roof slab with directional reinforcement spanning between them to create the roof beams (1). The columns have been designed to a diameter of 200 mm and provide an effect of slender, almost under-sized, elements within the space. This diameter is too narrow for standard reinforcing details (2) and leaves little space within the formwork for traditional vibrating techniques. A high-strength liquid slurry mix was devised for the columns requiring care during pouring to prevent stratification or creation of air holes within the concrete. The mix cures to approximately 80 MPa strength and, through the use of a plastic interlayer placed within the spiral form tube, has the visually desirable effect of a highly-polished, almost stone-like finish (3).

The design intent was to clearly delineate elements of the structure within a single structural form (4). For instance, the circular plan form of the room is scribed into the underside of the slab, to emphasise the 'plastic' nature of the concrete and to belie the sense of weight within the small room (5). For this reason, incision-like elements were formed

Victoria

1 PLACEMENT OF THE FORMWORK AND REINFORCEMENT PRIOR TO POUR NOTE THE RUBBER-TIPPED VIBRATOR TO PREVENT DAMAGE TO FORMWORK 2 COLUMN AND REINFORCING CONNECTION TO ROOF SLAB 3 NEW STRUCTURE SHOWING 180-MM THICK SLAB-ON-GROUND IN RELATION TO THE EXISTING CONCRETE WING WALLS 4 SIDE VIEW OF THE STRUCTURE 5 INCISION-LIKE REBATE IN THE SOFFIT 6 SIDE VIEW OF COMPLETED SITTING\MEALS ROOM 7 DETAILED CONNECTION TO EXISTING CONCRETE WING WALLS 8 INCISION VIEWED FROM UNDERSIDE OF THE SLAB 9 APPARENT LIGHTNESS OF THE ROOF SLAB 10 DETAIL OF WINDOW HEAD AND PELMET NOTE THE GLASS-LIKE FINISH OF THE STRUCTURAL COLUMNS 11 FRAMES HUNG OFF THE STRUCTURE 12 CONCEALED DEPTH OF THE ROOF SLAB

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within the soffit, reinforcing the interlocking geometry of the room from within (7, 8, 9). An acrylic cementitious scim coat was smooth trowelled to the underside of the off-form concrete slab and left unpainted.

Externally, it was important to conceal the depth of the roof and to separate the structural slab from non-structural elements. For this reason, the eave was rebated to a depth of 70 mm and designed so that the steel-framed window section sits proud of the concrete, forming an inverted pelmet for the placement of curtain tracks. The mullions were designed with deliberate effect to emphasise the 'hung' nature of the glazed curtain wall (10, 11).

Given the proximity of deciduous trees, roof spouting and box gutters were avoided and the roof slab designed with a 70-mm fall to the perimeter (12). Roof water is expelled beyond the line of the glazing using a traditional steel projection bar at the window head and collected in a sub-ground drainage system. A butynol roof membrane was installed over the slab to prevent any form of water penetration in the event of cracking in the roof slab.

The use of concrete provided a means to clearly delineate the geometry of the room whilst unifying it as a single structural form (6). Considered as a 'parasol' which divides the house from the garden, the design acknowledges precedence in the work of Kevin Borland to which it connects. In the context of small-scale domestic work, which often takes the form of a tack-on out the back, this lean-to addition has provided the house with a degree of permanence.

ARCHITECT:
Robert Simeoni Architects PL
COMPLETION: October 2003
STRUCTURAL CONSULTANT:
Bonacci Group PL
ARTICLE/PHOTOGRAPHY:
Robert Simeoni

CCAA publications and technical notes are on-line: www.concrete.net.au

Specifying Paint

Introduction

Applied surface coatings offer simple and diverse solutions to alter the appearance of smooth flat concrete. Notwithstanding aesthetic intent, the main function of protective surface coatings should achieve one or more of the following:

- to inhibit water penetration, water vapour transmission and carbon dioxide permeability;
- to minimise chemical and physical attack due to weathering or industrial environments;
- to mask imperfections in cases where the substrate is defective.

Whilst the range of surface coatings available is extensive, including pigmented stains, cement paints, distempers and high-build textures, this specification focuses on applying paint to concrete walls.

FURTHER REFERENCES

AS 3600 Concrete Structures makes mention of an S-Class concrete that can be used to specify colour concrete applications.

AS 4548 Guide to Long-life Coatings for Concrete and Masonry (Parts 2, 3, 4) specify requirements for latex finishes, textured and aggregate-filled coatings. Exterior applications of water-repellent coatings are covered in *AS 1580 Paints and Related Materials.*

Note: Class 3 off-form finishes may require further work for a satisfactory paint finish seen at close quarters. A significant contractual issue which commonly arises, concerns who is responsible for the repair of the surface (blow holes, face steps or honeycombing) prior to coating. Unless otherwise agreed, this treatment is usually the client's responsibility.

Influence of the Substrate

Paint is generally a low-build coating - the thickness of two coats is in the order of 50 microns. Whilst applied textured coatings tend to diffuse light across the concrete surface and mask imperfections in the substrate, strong glancing light on painted concrete will emphasise any unevenness or surface defects.

Architectural concrete to be painted should comply with good concreting practices to either a Class 2 or Class 3 finish. *Since AS 3610 Formwork for Concrete* does not apply to subsequently-treated surfaces, the approval of samples of the required colour, texture and finish, is essential to the successful appearance of painted concrete.

Selection and Criterion

Paint can be used effectively and economically in architectural work to emphasise the scale of a structure, to reinforce the texture of off-form work or to provide accent. But even the more artistic use of paints such as sprayed graffiti or stencilled signage, will need to satisfy the following requirements:

- good bonding within the paint system;
- painting over with the same paint;
- resistance to UV light;
- a low tendency to attract dirt; and
- resistance to flowing water and/or washing.

The concrete mass or bulk imposes secondary, but important effects on the performance requirements of the coating. Resistance to alkali is essential and long-term flexural strength is required to cope with the substrate's expansion and contraction. Exposure to the environment will influence the coating's long-term performance and the manufacturer's advice should be sought with regard to adhesion, viscosity, hardness, drying time and coating thickness.

Preparation of the Substrate

The composition of the concrete surface is complex, varying in both physical and chemical terms. The preparation of the substrate is essential to maximise the adhesive (interlocking) and cohesive (chemical bonding) interface between the coating and concrete.

All traces of foreign surface materials such as bond breakers, release agents, curing compounds, laitance, oils and mould, must be removed as they may be incompatible with the coating or affect the bond with the substrate. Preparation methods include high-pressure washing, use of proprietary cleaning agents and, if necessary, a mild acid wash of 1:25 dilution.

The simplest method of checking for residual trace compounds is to splash an area of the surface with water. The water should be immediately absorbed, darken the concrete, and not bead on the surface. If a slippery, shiny or an oily film forms, then there is still residual compounds to be removed.

The presence of laitance impacts on the effective binding of paints to the substrate. For example, in latex paints, the binder comprises small globules of resin suspended in water in which the pigments and additives are embedded. As water evaporates the globules coalesce to form a solid elastic film which adheres firmly to the concrete. Where loose particles are present, the globules of resin will merely sit on the top layer or cement scum, with little or no adhesion to the substrate proper.

The moisture level of the concrete surface at the time of application must be no more than 5%. Excess moisture may prevent the coating from adhering and the manufacturer's advice should be sought as to acceptable levels. Concrete should be left for a minimum of 28 days to cure and then the moisture content checked with a moisture meter. A simpler method is to attach a 1 m^2 sheet of impermeable plastic to the surface for 24 hours, sealing it around all edges. If after this time, moisture is visible on the inside face of the plastic, then the moisture content is still too high to apply the coating.

Paints

The variety of paints is extensive and whether they are solvent, aqueous, clear, pigmented, hard or elastomeric, the materials used are primarily those minerals, silicate, dispersed synthetic or polymer resin paints, which harden in the air. Any concrete surface that is meant to receive a low-build paint coating and then be seen at close quarters, should have a skim coat specified under the paint system. Sealants can partially fill the capillary pores near the surface of the concrete substrate forming a thin contiguous surface film which reduces water absorption and carbon dioxide diffusion.

Latex paints are generally alkali-resistant and can be applied directly to the surface by brush, roller or spray. Since the resin globules are not absorbed by the substrate they will have the same gloss-specular irrespective of whether the surface is sealed. Polyurethane paints can be formulated to produce flexible waterproof coatings with good UV resistance. Water vapour does not pass through them easily, so they cannot be used on damp concrete.

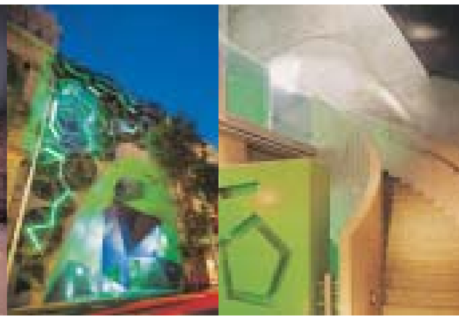
ACKNOWLEDGEMENTS: Eric Lume and Adele Brooks;
Concrete Construction Manual, Birkhauser Edition Detail, 2004 (page 74);
The Concrete Panel Homes Handbook, CCAA July 2001 (pages 33-36); EBS Notes on the Science of Building, NSB 147 and 148

Value-Added Concrete

Kings Road House, North Hollywood

1921 RUDOLF SCHINDLER

1958 LE CORBUSIER



1997 ASHTON RAGGATT MCDOUGALL
Photo credit: John Gollings

In response to his wife's request to paint her half the so-called Kings Road House, Rudolf Schindler proffered his strong objection by letter stating: 'Madam...Kings Road was built as a protest against the American habit of covering their life and buildings with coats of material to fool the onlooker about their common base...Kings Road was conceived as a combination of honest materials, concrete - redwood - glass, which were to be left to show the inner structure and their natural colour'.[1]

On the face of it, his objection was reasonable. Constructed in 1922 on a site located south of Sunset Strip in North Hollywood, the house was Schindler's first independent work in Los Angeles. He had designed it whilst running Frank Lloyd Wright's office who, since 1919, had spent much time in Japan supervising the Imperial Hotel. Typical of Schindler's early work, the house experimented with tilt-slab reinforced concrete construction and used an integral footing-slab to serve as the formwork to pour the concrete walls.

But equally, her request was not entirely unreasonable. Afterall, the house was designed for two families and incorporated independent L-shaped wings which spun out from the site in a pinwheel. So successful was the arrangement of fixed plan and free section, that the house sustained a series of occupancies which even now, appear as something out-of-the-box: a two family share household; half rental property, half private house; part house, part studio. At the time of her request, the house was again occupied by the Schindlers, but this time in separate wings.

Trained in Vienna, and aware of the radical aesthetic purism propelled by Adolf Loos' *Ornament and Crime*, Schindler was no reductivist. The house design is instructive in its spatial convergence and interlock between the interior and outdoor gardens. Polemics on structure and function were also of limited interest. Schindler was not invited to participate in the first architectural exhibition of the Museum of Modern Art in 1932 (The International Style: Architecture since 1922). Indeed, he looked upon his omission agreeably, advising Philip Johnson that: 'my work has no place in it. I am not a stylist, not a functionalist, nor any other sloganist. Each of my buildings deals with an architectural problem.[2]

That the concrete walls should not be painted might be attributed to Schindler's exposure to Otto Wagner, who, drawing on architectural theorists such as Gottfried Semper, counselled for a kind of ornamentation that comes from the logical use of materials. At Kings Road, the walls of the house were cast in slabs one metre wide and two high with a significant taper from top to bottom. Clearly, man-handling the panels side-by-side was difficult so they were tilted upright into position.[3] The intermediary vertical slots were glazed and allowed light to slip in through the back walls of each wing. The surfaces were not planes with equal tension in all directions; they were more like the stiffened sides of a tent, with negative studs to emphasise the condition.

Given hindsight, the least convincing aspect of Schindler's objection relates to the idea of concrete as 'natural', like timber. The word concrete is derived from a Latin verb and literally means to grow together.[4] It is a conglomerate ordering of materials which, whilst deriving strength and durability from the hydration of calcium silicates in the cement, is open to a wide array of permutations in form.

That concrete has no 'natural' or 'fixed' appearance is understood intuitively today. Recently, Guyer & Gigon's signal box in Zurich incorporated iron oxide to give the concrete a rusty look; conversely Donovan Hill's GPN3 building in Brisbane incorporated grey oxide to improve the appearance of concrete as 'concrete'.

Concrete is designed to be plain or coloured, coated or texturised; paint is just another constituent in the mix. This is clearly evident in the concrete portals over the crypt space in La Tourette, which are painted cherry, blue and white and provide an intense brilliance within the space. Similarly cogent, is the glossy apple-green and purple over-spray entry to Storey Hall.

Schindler objected to the house being painted because he had clearly defined what features belonged to the plan and what belonged to the material. His house was a manifesto on a way of life, not a lifestyle. It was complete.

1. James Steele in R.M. Schindler Taschen 1999 p.24
2. Judith Sheine in R.M. Schindler GG Publications 1998 p.9
3. See Reyner Banham in *A Critic Writes* for a comprehensive account of the concrete pp.171-3
4. R.F. Stanfield, *Protective Coatings for Concrete* OCCA Conference 15 Nov 1988 p.152

Etching Images Into Concrete

TIPS

A recent upgrade of the Sir Charles Gardiner Hospital (SCGH) in Perth, incorporates two series of photo-etched concrete wall panels as part of the Per Cent for Art Programme. The panels, which were designed by Penny Bovell and Brigitta Hupfel and fabricated by Margaret Dillon and Simon Gauntlett of Concreto, are located at the emergency department entrance and inside the waiting area. Each wall panel is 5 m long, 500 mm high and 50 mm thick, and comprises eight units depicting images assembled from the idea of 'a walk through the park'.

The process of casting the panels is the result of Concreto's investigations into photo-etching techniques which dates from 2000. For this project, surface set retarders were sourced from the French manufacturer Pieri and imported to Perth via a contact in Dubai. Initially, the images were created on a silk screen by means of a transparent positive and transposed to a light-sensitive material. The screen was then used to print the solvent-based set retarders onto a polypropylene formliner. The cement paste which was prevented from setting by the chemical was washed-out after a period of 24 to 48 hours exposing the aggregate. The panels for SCGH use a high-cement content and small aggregate. The panels in the internal waiting room utilise a 0.5 mm clean black granite dust, whilst outside a 2-5 mm black marble chip was utilised. White cement was used to maximise the contrast of the image.

The process of working out what mix works best with which set retarder is ongoing; some chemicals retard the concrete to a depth of 5 mm, others only 1 mm. A deeper etch is more likely to reduce the resolution of the image. Cement content and aggregate size also affects the results; the more cement-rich and the smaller the aggregate, the greater the resolution. The mix design and set retarder must suit the individual project. For example a deep etching material and a 7-mm aggregate with very little fines, will produce a rough texture and a resulting loss of detail. More cement will reduce the depth of the etch, but will increase the resolution of the image with a dot size of 0.25 mm possible.

The results achieved for this project were possible with carefully controlled workshop conditions. Concreto are currently investigating the requirements for the production of large-scale images which are suitable for precast walling.

LOCATION: Sir Charles Gardiner Hospital Emergency Department, Perth WA
PANEL DESIGN/ARTWORK: Brigitta Hupfel and Penny Bovell
FABRICATORS: Margaret Dillon and Simon Gauntlett Concreto [08 92277669]
COMPLETION: June 2004
ARTICLE: Simon Gauntlett