

## Going Precast by the Waterside

There is something about living by the waterside that appeals to many people. Perhaps it is the feeling of being one with nature. Or it could be the sound, the ambience, or the whole enchantment of living so close to a river or lake.

In the two projects that are featured in this issue of PREFAB Architecture, the main attraction of each project is the fact that the developments are located next to a river. Besides giving that special ambience, the proximity to the river also plays a role in inspiring the design for riverside housing.

While Sanctuary Green blatantly projects the nautical theme through many of its forms and elements, Freesia

Woods is slightly more subtle with its message, incorporating wave-like curves in its façade. It goes without saying that both designs were made possible by the flexibility and precision offered by prefabrication techniques.

Of course the Kallang River and Sungei Ulu Pandan may be just mini rivers compared to the magnificent oceans located all over the world. An excellent example would be the Pacific Ocean where classic dream houses are perched atop the cliffs facing it. Nonetheless, riverside housing developments in a tiny state like Singapore still have plenty to offer in their unique architecture and high quality finishes achieved through precast construction.

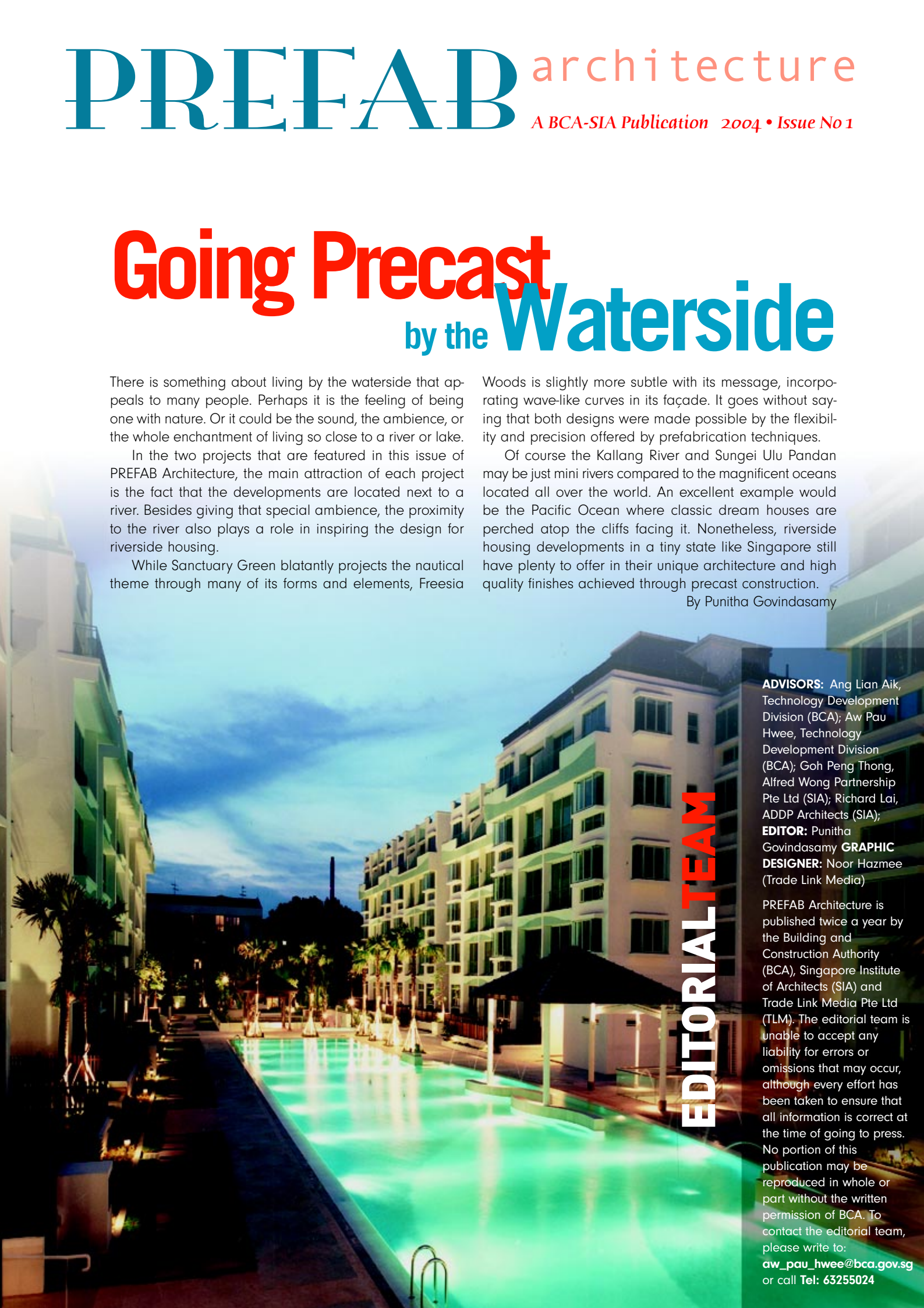
By Punitha Govindasamy

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EDITORIAL TEAM



# The Precast Wave

By Richard Lai Teck Chuan



***Wave-like curved moulding on precast balconies typifying flowing water at Sungei Ulu Pandan.***

**F**reesia Woods, nestled amidst the low-rise quality housing along Sunset Way, is a contemporary and timeless expression of riverside living, characterised by spacious floor plates, tall windows, attics and balconies all elbowing for attention and spaces close to the water. Set in a continental environment in harmony with the serenity of the river and the nostalgic railway track, it is indisputably a rare jewel for resort living. The development responds to the solar orientation through its north-south facing layout and provides a wholesome view of the water and to some units, an unobstructed view of a hill at the far end of Sunset Way. The building culminates from the generous pool deck into a picturesque pitch roof apparent from the street level.

This prestigious development, awarded in 2001, com-

prises 129 units in 4 blocks of 5-storey apartments, each offering a choice of 1, 2+1, 3 and 4 bedroom apartments.

The main façade adopts a layering of the different planes depicting the extension of the unit into landscape, swimming pool and the river. This visual expression is apparent from the opposite side of the Sungei Ulu Pandan that runs parallel to the development.

Precast wall panels with bay windows and bottom-hang windows provide not only a visual extension of the bedrooms but also a practical provision whereby windows can remain open under wet weather conditions allowing good natural ventilation within the unit.

Precast planters in front of the living and dining areas provide another layering to the façade creating a softer touch to the concrete structure and complementing the



***Creating a Mediterranean look using precast facade.***

Mediterranean look of the development.

The various types of precast air-con ledges and the projecting precast balconies create the layering of the façade including the wave-like curved moulding typifying the flowing water at Sungei Ulu Pandan. All of which would not have been successfully executed without precasting as the quality and consistency in the finishing work could either make or break the beauty of the alluring façade.

Apart from the façade of the units, the other elements also adopt various forms of precasting. They include staircase façades that are both flat and curved, flights of staircase including the landings, walls of the lift core and reinforced concrete parapets.

These precast elements were integrated into the conventional in-situ beam and column frame structure construction through collaboration between the precaster and



***Installation of precast components in progress.***



***Layering of the facade.***

***The synchronised precast waves echoed in the pool.***



***Riverside living at Freesia Woods.***



the structural engineer to ensure a good fit in rebar positioning during the erection. The precast elements are easy to install and need only simple touch up work after installation.

All the precast concrete façade elements were designed as critical elements, which had to be installed prior to the casting of the horizontal floor structure. Such design ensures better water tightness performance, which is undoubtedly expected from a typical external wall.

In conclusion, precast construction implemented primarily for the external façade has led to a highly consistent alignment for all floors, which has aesthetically added to the overall effects of the development and the quality of finishing required of the façade and balconies.



***Curved precast staircase wall along Sunset Way.***


***Single integrated precast staircase walls with landings and steps. Reinforcement bars from the precast staircase walls are extended into the in-situ columns***



## PROJECT TEAM

Client : Keppel Land Realty Pte Ltd  
Contractor : Santarli Construction Pte Ltd  
Architect : ADDP Architects  
C&S Engineer : DE Consultants (S) Pte Ltd  
M&E Engineer : Alpha Engineering Consultant  
Quantity Surveyor : Davis Langdon & Seah (S) Pte Ltd  
Precaster : Excel Precast Pte Ltd





*Sand stone texture buttress walls.*

# “Resort style Urban Home”

By Yvon Yap

**S**anctuary Green comprises 522 units, spread over 5 tower blocks, which range from 7 to 19 storeys in height. So far, 3 blocks have been completed. The other 2 blocks are still under construction, with just interior and road works left to go and should be completed by the middle of this year.

The architectural design for Sanctuary Green, a URA land parcel, was conceived with the ‘City - Waters - Resort’ theme which was in line with URA’s aim to provide resort style urban high-density waterfront development for the Kallang Basin. Although the terms ‘resort’ and ‘urban’ may seem contradictory, it actually opens up exciting possibilities for fresh ideas.

The vibrancy of the city that is only an 8-minute drive away coupled with images of water scenes, exude a sense of festivity and excitement which the design scheme follows closely. The site’s natural orientation towards the sea is blatantly felt in the strong resort theme.

Some of the forms adopted for Sanctuary Green are derived from nautical symbols too. From sand stone texture entrance buttress walls, to the highly raked roofscapes and the tensile sail at the entrance, the affinity to wave breakers, sails and masts cannot be missed. The theme is also carried throughout the soft and hardscape elements in the open spaces with boat-shaped play equipments, boardwalk pedestrian linkages and beach resort pool concept with palms and frangipani trees at the pool deck.

The roof profile comprising a simple two-sided pitch is very much a part of the overall nautical theme. Coupled with different building heights, the waffle pitch roofs look like sails in a free spirited roofscape.

This project was originally conceived to have external plastered brickwalls, which was later changed to precast façades instead. Being denser, precast façade not only helps to minimise water seepage but also improves the buildability of the project. In addition, precast façade exudes unparalleled smoothness and precise alignment that is most obvious under the bright afternoon sun.



***Excellent surface and alignment achieved through precast construction.***

***Casting of precast façade on site.***



The effectiveness of water-tightness, which is quite crucial in precast projects, depends greatly on the design of joints and the type of sealant used. In this project, the precast façades were secured in place by dowel bars which were extended from the precast façades into the cast-in-situ columns and beams. A simple rebate was created around the edges of the precast façade panels and polyurethane sealant was used to fill up the joints. In addition, a 50 mm recess was created on the edge of the floor for the precast façade to sit on to act as a second defence line against water seepage.

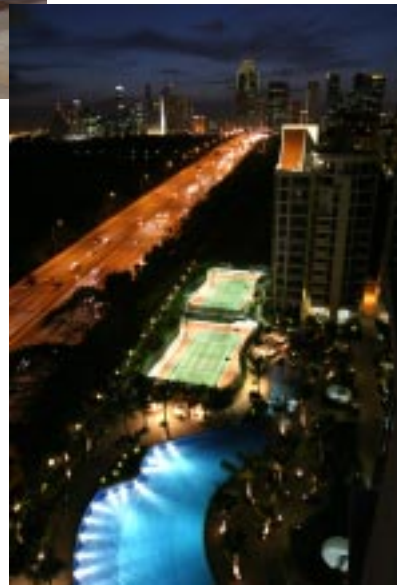
Other precast components used in this project include balconies, staircases and parapet walls. In particular, the creative mix of curved, triangular and rectangular precast balconies reflects the 'plasticity' of precast concrete.

The production of more complicated precast compo-





***View from the pool. Interplay of circular and triangular precast balconies with octagonal roofs provides exciting variations to the façade.***



***Picturesque night view of urban waterfront living.***

nents such as staircases were carried out in the factory. The tight quality control in the factory enabled the desired dimensions, shapes and textures of the components to be achieved easily. The relatively simple precast façade panels were cast on site to minimise handling and transportation costs.

By combining precast and cast-in-situ construction techniques, the amount of wet trades was reduced significantly. Furthermore, the contractors managed to deploy their resources more efficiently without relying too much on heavy equipment like tower cranes.

The successful conversion from plastered brickwall to precast façade shows that precast design is a viable solution for residential projects. The use of precast construction has enhanced the quality and aesthetics of the overall project.

## PROJECT TEAM

Client : Sanctuary Land Pte Ltd

Contractor : Kimly Construction Pte Ltd

Architect : SEP Partnership

C&S Engineer : Engineers Partnership

M&E Engineer : Technocon Engineers (S) Pte Ltd

Quantity Surveyor : Jia Quantity Surveyors & Project Managers Pte Ltd

Precaster : Kimly Construction Pte Ltd / Poh Cheong Precast Pte Ltd

# Inclined Precast Planes



***(From left) Front façade - passive design principles were integrated into the overall concept; View from cul-de-sac showing inclined concrete planes.***

**T**his tilted precast concrete house, within the expanse of suburbia between Perth and Mandurah, is located in a cul-de-sac overlooking one of the greens of the Meadow Springs Golf Course. Without any architectural reference point to draw from, the idea was to have the dwelling fold back in on itself, self-referencing but paradoxically contextual. The front and side walls of the house lean back at seven degrees as if buckling under the pressure or vacuum that surrounds it. From the street, the solidity of the concrete panels dissolves into glass at the rear of the building, where it opens up to take in north light and air as well as views to the garden and golfing green opposite.

This freestanding suburban house, comprising three bedrooms, a study, two bathrooms, an upper-level mezzanine, a ground level open plan living/dining/kitchen and an enclosed double garage, was built in approximately seven months.

Given the temperate climate, the thermal mass of the concrete walls and floor slabs assist in stabilising tem-

peratures within the dwelling. Passive solar design principles were integrated into the overall concept. As a result, there are no east or west facing windows. South-facing windows are small and well-protected with protruding plywood window-boxes fixed directly to the concrete panels. Extensive glazing was concentrated on the north side of the dwelling under protective overhangs, allowing solar winter gain and summer shading as well as accessing views to the golf course.

The construction system adopted was precast concrete panels and concrete ground and suspended slabs, tied together at the top of the panels with the roof steelwork. All the panels span vertically, in some cases over two floors to the void areas. These were achieved using 150 mm thick panels. The single-storey garage panels were reduced to 125 mm thick. The motivation for using this construction method was to achieve some degree of efficiency in construction time and cost.

Significant cost savings were achieved by doing away with plasterboard linings to the internal precast panels. The panels were steel trowelled to a smooth finish on



***(From left) Rear north-facing façade has extensive glazing with protective overhangs; Vertical recessed bands were used as a graphic device and cast into the panel at the front entrance; Front façade detail showing timber window brise-soleil.***

one side during the precast production process giving a polished finish. The concrete panels joints were cleaned up on site and skimmed using 10 mm negative profiled expansion joints internally and standard silicon joints externally. A standard grey concrete mix was used to keep costs down. At the Main Entry, recessed bands running horizontally between windows and vertically at the entry were cast into the panels and used as graphic devices to articulate the south façade.

The advantages of a precast system to the builder were an accelerated construction period and minimal time required for external and internal scaffolding. As for the architect, the major advantage was the freedom that precast concrete allowed in the design process without turning to lightweight construction. Achieving the inclined front wall at seven degree was relatively easy with bracing to the suspended slab and roof steel. The recessed banding was also achieved easily and cost effectively within the thickness of the panels. Almost all the precast concrete was painted externally in the shades of cream/white and internally in shades of white/grey. The external

panel finish was smooth enough not to warrant the use of a textured paint, a further cost saving. The recessed banding was simply clear-sealed to express the true colour of the grey-concrete panels beneath, the vestige of an original idea to leave the whole exterior of the house in its raw and natural concrete state.

## PROJECT TEAM

Architect: Joe Chindarsi  
Structural Engineer: Burdett & Associates  
Builder: Developments West  
Precaster/Concretor: Go-Crete Pty Ltd  
Photography: Joe Chindarsi  
Climate: Warm temperate  
Dwelling Type: Detached, two-level  
This article first appeared in C&CAA Journal, Mix Volume 11 Jan 2003.

# High Comfort- Low Energy Building using Insulated Concrete Sandwich Panels



The design intent for this three-level residence was to showcase the benefits of living and working in a high thermal mass construction by using insulated concrete sandwich panels. The result is a unique family home with a finely executed design, predominantly in concrete. The architect has achieved a feeling of lightness with heavyweight materials through careful management of proportioning and finishing of the building envelope.

Family accommodation extends over the ground and first floors while the basement level is divided between guest accommodation and office for the Melbourne headquarters of Composite Systems Pty Ltd. This residence is one of an asymmetrical pair designed by de Campo Architects.

The principle structural elements consist of Thermomass precast walls and hollowcore precast con-

crete planks for floor/ceiling/roof slabs that were all manufactured and installed by the one contractor. Other exposed concrete elements include a staircase of floating concrete treads, wet area surrounds in bathrooms and shower-base.

The precast walls comprise an inner leaf of nominally 150 mm concrete, a 50 mm interlayer of Styrofoam insulation and an outer skin of 65 mm concrete tied together with composite-fibre thermal connectors. This system provides a fully insulated internal thermal mass with the added benefit of external solid construction. The Thermomass walls throughout the residence both internally and externally have almost all been left as plain grey as-delivered concrete. A square edge was specified for all the panels giving a less industrialised appearance while maintaining a sense of solidity. Recessed caulking details were specified at smaller panel junctions.



***(Clockwise from left) Precast concrete stairs; Front façade showing a mixed palette of concrete and timber elements; View of dining area - Thermal bridging of wall to window junction were resolved with carefully prepared shop drawings for the precast concrete walls and slabs; The north-facing living area is designed to admit and store solar gain during the cooler months with high thermal mass concrete elements.***

The concrete roof is constructed using hollowcore concrete slab as the structural unit with a 60 mm screed placed over as a binding slab. A waterproof bituminous membrane was installed directly over the screed with a layer of expanded polystyrene placed over it.

Shop drawings for the precast panels required diligent assessment and checking to ensure a continuous thermal envelope was specified at complex junctions, notably at three axis-plane intersections. This was closely monitored during manufacture to ensure the thermal envelope was maintained at panel joints, around corners and at the connection to roof slab. Care during delivery and installation was also required to maintain quality control and avoid damage.

The result is a home with a very high comfort level due to the acoustic and thermal properties of the technologies employed.

## PROJECT TEAM

Architect: de Campo Architects  
Structural Engineer : Bruce Adams Consulting Engineers

Builder/Concretor: Lucchese & Donazon  
Manufacturer/Installer : Westkon Precast Concrete Pty Ltd

Photography: Shannon McGrath

Awards: Francis Greenway, Society Green Buildings Award, 2002 Bronze Medal

Climate: Mild temperate

Dwelling Type: Semi-attached, three-level

Acknowledgement: Chris de Campo, de Campo Architects; Mikael Carlstrom, Composite Systems Pty Ltd; George Cremasco, Westkon Precast Concrete Pty Ltd

Link : [www.compositesystems.com.au](http://www.compositesystems.com.au)

This is an edited version of an article that appeared in C&CAA Journal, Mix Volume 11 Jan 2003.

# Innovative buildablesolutions



**(Clockwise from bottom left) The Istana Park; King's Centre; NUH Radiotherapy Centre; The Esparis.**

**Prime Structures Engineering Pte Ltd** is a staunch follower of the building industry's steadily growing trend towards design and build. Its strengths include innovation, in-depth knowledge, and comprehensive facilities

coupled with a team of experienced engineers. Through strategic alliances, it has successfully completed projects in Singapore, Malaysia, Brunei, Thailand, Hong Kong, Taiwan, Sri Lanka, Africa and the Middle East.

From January 2004, with more emphasis being placed on the buildability of wall systems, the weightage for walls has been increased from 30 to 40 points in the revised Buildable Design Code of Practice. This is where Finewall with its high Labour Saving Index will come in handy to increase the buildability scores of projects significantly.

Installation of these dense and robust panels is a breeze as they are lightweight at only 68 kg/sq m. The walls can be cut and fixed on-site with simple tools such as a saw, wood chisel and wood drill. The smooth finish surface of the panels also eliminates the need for wet works such as plastering. Finewall, with its unique combination of strength, quality and buildability is ideal for most projects.

Finewall has been successfully used

in many private residential projects such as The Esparis, Changi Rise, Nuovo, Emery Point as well as commercial projects like the PWC Building. Besides Finewall, Prime Structures also offers a range of innovative products such as system glass or polycarbonate skylight, system ball joint spaceframe and custom-made or pre-fabricated steel and aluminium structures.

Besides enhancing buildability, these products also add creative touches to the aesthetics of the buildings. This range of products has been used in prominent projects such as King's Centre, glass conservatory in Botanical Gardens and the Istana Park.



**Finewall from Prime Structures.**

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**Worley** is a publicly owned multi-disciplined engineering consultancy, established throughout Asia.

Worley encapsulates the technology of a number of divisions of specialised engineering consultants covering all aspects of the engineering services industry. The Worley group forms one of the largest multi-disciplined consultancy operations in the Asia Pacific region.

Worley **Industrial and Infrastructure** is the customer service group within Worley that delivers projects in the Building, Transport, Industrial and Defence sectors.

Our group's vision is to be seen by all of our clients as the engineers and project managers of choice. We strive to deliver innovative solutions aligned to Client objectives. Our focus on working closely with our clients has provided exceptional outcomes on other projects by continually striving to:

- *Successfully deliver projects, by understanding our clients needs*
- *Select high quality individuals and create a rewarding working environment*
- *Commit to long term relationships with our clients*
- *Test the norms and seek creative, cost effective, whole of project solutions.*
- *Be a pro-active team player and develop innovative solutions*

### SPECIALIST BUILDING SYSTEMS

Worley, in association with its clients, has developed specialist building systems that specifically suit the needs of the contractor, developer and end user. Systems have been developed on large residential projects which have high repetition, with the result of reducing construction costs whilst improving quality and speed of construction. The Industrial and Infrastructure group has successfully designed in excess of 20,000 apartments in Australia, Singapore, Malaysia and Thailand.

Worley can provide specialist expertise as follows;

- *Optimisation analysis of structure*
- *Structural Engineering design and documentation*
- *Development of systems to suit geographic, cultural and cost requirements*
- *Precast shop drafting and detailing*
- *Load testing and verification of connections or structural members*
- *Structural certification and submission to the authorities*
- *Training of labour by experienced construction supervisors*
- *Construction supervision*

### SAMPLE PROJECTS

*TANGLIN VIEW (SINGAPORE)*  
*Client: Chiu Teng / Multiplex JV*

This S\$80 million project was initially tendered using conventional construction. An alternative bid using precast concrete walls and slabs, and a grouted temporary retaining wall was accepted as the winning bid.

**This project won the prestigious "Best Buildable Design Award" given by the Building and Construction Authority of Singapore in 2002 and was the Joint Winner of the MBA National Exporter of 2002 for Building and Construction Contractors.**



*KERRISDALE (SINGAPORE)*  
*Client: Kimly Construction Pte Ltd*

The project consists of 520 apartments in 3 buildings of 31 storeys each and a 6-level post tensioned carpark. Worley produced an alternative precast design which was subsequently adopted for the project. Precast was used for the external facade walls, planter boxes and all internal walls.

Insitu concrete was adopted for the lift/stair walls, columns and slabs. Worley produced precast shop drawings for all precast elements of which there are approx 30,000 in total. All precast elements

were cast on site, and lifted directly using the tower crane.



*YARRA CONDO (MELBOURNE, AUST.)*  
*Client: Auscor / Thiess*

This A\$25 million project consists of a single 19 storey structure, with the first 3 stories being a car park podium. An alternative bid adopting the Ultrafloor (a type of precast plank) flooring system and precast load bearing walls and columns was presented and accepted as the winning bid.



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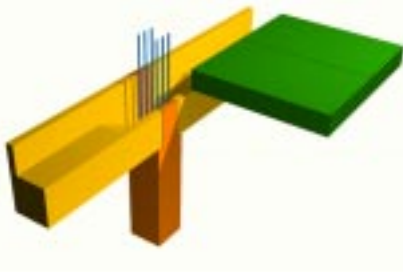
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# Maximising<sup>the</sup> Benefits of Precast Design



Several local contractors have been increasingly enjoying the benefits of the innovative precast design of **WP Brown**, an Australian firm that has been providing personalised service with a technological edge in Singapore for the past 12 years.

WP Brown designed precast shell columns for the Sengkang Primary School Design & Build project (below), enabling Neo Corporation to eliminate all formwork at the beam joints. Lapping of the column bars did not require sleeves or grouting and there was also considerable savings in the crane costs as a result of the lighter components.

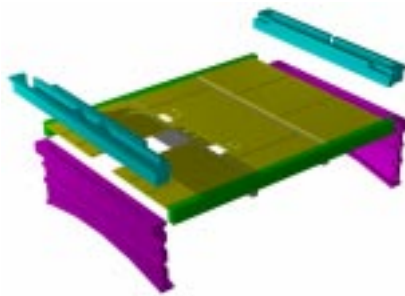


Goldenhill Villas, a residential development of 83 terrace house units (below) was constructed by Tiong Seng Contractors using full precast construction designed by WP Brown. The precast load

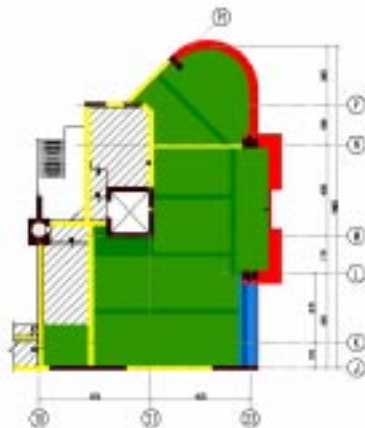


bearing party walls proved to be neat and cost-effective. To simplify the installation of the precast beams to the walls, a pocket system was used. This also helped to eliminate the formwork for casting the wet joints.

WP Brown's precast beam and slab design made construction over a 6-storey high void relatively easy for Poh Lian Construction at the Amaranda condominium site (below). Substantial time savings were also achieved because all propping was eliminated.



The Nuovo EC project in Ang Mo Kio features a precast floor system and façade panels designed by WP Brown (below). Custom designed prestressed precast slabs were used to minimise the number of floor beams. The curved cantilever floor for the master bedroom used precast slabs with an integral fascia and



ledge, avoiding the need for difficult formwork and the associated quality control issues at site.

For Esparis EC, Ando Corporation adopted precast components for all vertical elements and the entire facade resulting in improved quality and speed of construction and the elimination of external scaffold. WP Brown's design concept included load bearing external walls, designed as plain concrete members (below). Economy is achieved because the concrete in the panels is contributing to the building structure, whilst the plain concrete design minimises the number of vertical bars to be lapped at each floor level.



These case studies show the results of WP Brown's strong emphasis on design for buildability, technical strength and experience in precast design and construction.

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