

PREFAB architecture

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Goldenhill Villas - going precast

By Ong Eng Liang, MSIA
S. H. Lim Architects Pte Ltd



Nestled within a mature conventional landed housing estate in Ang Mo Kio Ave 1 and Tai Hwan Crescent, the Goldenhill Villas development situated on a hilly site offers a panoramic view of the valley, hill and other landed houses beyond. With a site area of approximately 2.2 hectare, the land slopes 18 metres from one end to the other.

A total of 81 terrace houses and two semi-detached houses are currently being constructed. All houses are designed with three storeys with an open roof terrace garden to take advantage of the extra living spaces and beautiful view. Precast construction is being extensively used to complete this work, with several desirable results.

Façade of the two showroom houses that have been completed at Goldenhill Villas.

Message from BCA

The increasing demands for better quality make it necessary for the industry to adopt more pre-assembled products. The examples in this inaugural edition of the PREFAB Architecture highlight various prefabrication systems successfully adopted by our designers and contractors.

BCA is pleased to work with the industry to develop an advanced and competitive construction industry. This project is another successful private-public collaboration.

I would like to thank SIA for its strong support in the promotion of buildable design.

Chionh Chye Khye, CEO of BCA

Message from SIA

PREFAB Architecture aims to promote and upgrade the design techniques of prefabricated construction in Singapore. It will feature prefabricated solutions for buildings, especially residential developments, with local and overseas examples.

SIA is committing itself to work with BCA to continue promoting buildable design in Singapore. This newsletter will be useful as a reference for local architects and the allied professionals.

Hopefully, it will inspire more architects to seek a more innovative design approach.

John Ting, President of SIA



Interior of terrace house with 'through view' to the rear yard from the living room.



Roof terrace at corner terrace house.



Interior air-well looking up towards skylight and turbine ventilator.

The design concept

The design concept emphasises light, space, experience, clarity and precision of form. Clean, simple, linear forms and lines are employed throughout the house. The overall design values honesty, simplicity and integrity of the building elements. The details not

only look good, but they are modern, functional and follow the principles of sound architectural practices.

Provisions are made for crisp, simple and neutral backgrounds, allowing the occupiers to accommodate their individual tastes and expressions.

Like conventional terrace houses, the planning of the interior of the houses at Goldenhill Villas accommodates the customary practices, and normal requirements of typical Singapore home owners. However, contrary to the conventional terrace house, with its dark middle interior, natural light is introduced in both horizontal and vertical directions.

Upon entering the house, one notices a vista from the living room through the kitchen to the back yard. A three-storey interior air-well is similarly created culminating in light pouring into the dining room from above through a circular skylight and from the sides of a raised roof platform. Taking advantage of the natural light, all adjoining bedrooms have internal timber windows that look into this well-lit air well space.

Other vertical spatial connections and use of natural light are also introduced at staircase landings. This is achieved through staggering staircases in plan and visually segregating views at the staircases through supporting walls.

Other ecologically sensitive features include a turfed roof terrace. Turfing on roof terrace level expands the limited green garden space at the front yard, and at the same time, it provides the much needed insulation to the roof against the harsh tropical heat. The raised roof platform which earlier serves as a feature to introduce natural light into the air-well space below, now serves as a countertop for food, drinks and decorative items.



on their location, they can either be a welcoming feature or a challenge. To make the unsightly joints in the interior of the house less conspicuous, RC pour-strip with skim coat on walls together with careful planning have been applied.

Technically, RC pour-strip also provides for a watertight connection at the same time. Side panels for the corner terrace houses are made as large as they are practical. Joints are thus minimised or eliminated altogether.

The Golden Hill Villas development is self-contained and is only accessible from Ang Mo Kio Ave 1. Fortunately, the large development site is a blessing for panel transportation and erection of large panels using heavy construction machinery.

To make full use of the precast system, finishes such as the building façade's brick tiles are also precast together with the RC panels through the use of a pre-positioned mould. Besides ensuring that no messy tile installation work is carried out at the site, this method also allows the tiles to be installed with excellent workmanship with near perfect alignment.

Goldenhill Villas is an example of how design and good construction methodology can work hand in hand. Using precast technology, the resulting flow of horizontal and vertical space, its details and elements, show that functional and buildable forms can be exciting and good looking as well.

Precast construction

The developer has opted for precast construction for its better quality, consistency and better buildability. Many challenges have been overcome, not the least of which are costs and technical considerations. Fortunately, the strong, linear, clean form and lines that are highlights of the Goldenhill Villas' design are well suited for precasting. The hilly terrain and the staggering site arrangement of the houses, however, are challenges to the engineers and architects.

To better facilitate the construction process, the main contractor has taken over the responsibility of designing and building the structural and M & E systems.

Working with precast consultants appointed by the contractor, a precast system suitable for low-rise landed houses has been developed. Façade design and interior spaces have both been slightly modified where necessary to adapt to the system. The precast system consists of elements which apply to party walls, façade walls, floors and selected 'precastable' items, such as staircases, metre compartments and planter boxes.

Joints are integral parts of precast construction. Depending



Project Team

- Client :** City Developments Ltd
- Architect :** S. H. Lim Architects Pte Ltd
- Design Consultant :** Resources + Planning Design Consultants
- C & S Engineer :** Richard K. C. Lim & Partners
- M & E Engineer :** Alpha Engineering Consultant
- Quantity Surveyor :** KPK Quantity Surveyors
- Landscape Consultant :** ACLA Pte Ltd
- D & B Contractor :** Tiong Seng Contractors (Pte) Ltd
- Precaster :** Hong Leong Asia Ltd

**Goldenhill Villas-
construction using
precast technology.**

Precasting prevails at The Petals

By Richard Lai Teck Chuan
ADDP Architects

The Petals was conceptualised with a contemporary and timeless medley of geometric simplicity. Elegant with its gentle curves, the well proportioned building form flows upward with stepping tiers at its higher floors culminating into a picturesque crown pediment. The block design was generously provided with open balconies, decorative railings, private garden terraces, private roof garden and jacuzzi.

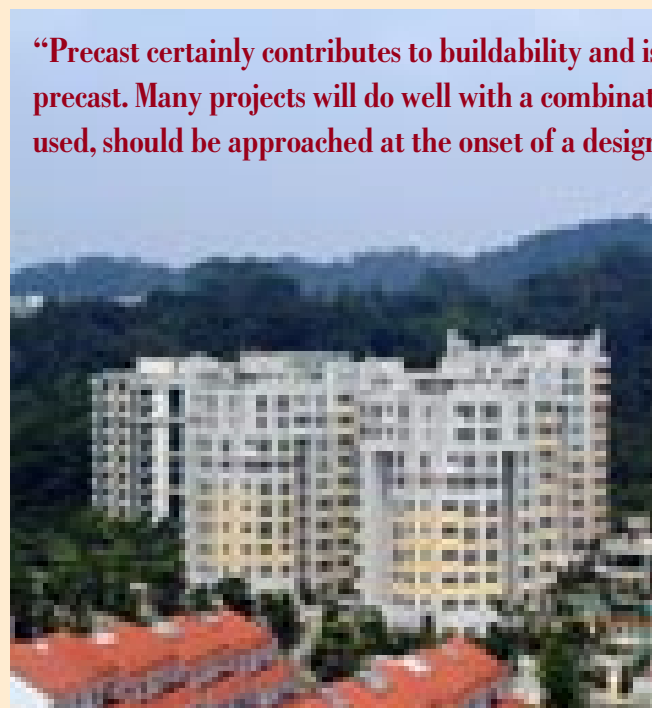
This prestigious development, located along Hillview Avenue, comprises six 10-storey apartment blocks (270 units), each offering a choice of 2, 3 and 4 bedroom apartments. The Design and Build project commissioned by Anchor Development Pte Ltd, was awarded to Santarli Construction Pte Ltd in late 1999.

Design

The architectural layout and façade design of the blocks called for many curves and non-linear profiles depicting The Petals' formation of a flower. This is an extremely tall order in the construction process, especially where good and consistent quality is con-



Majestic setting on a lavish landscape deck.



The curves and non-linear profiles depict The Petals' format

cerned. However, all blocks do have similar design features of curve and coping details including the curve planters. Four blocks are identical with the remaining two having some degree of design variation.

Precast option

Precast construction was used for the external façade to ensure consistency in the setting alignment for all floors, which is consequential to the overall effects of the development. The main considerations in adopting a precast solution are the nature of the façade design, and the quality of finishing required of the curved façade and the balcony.

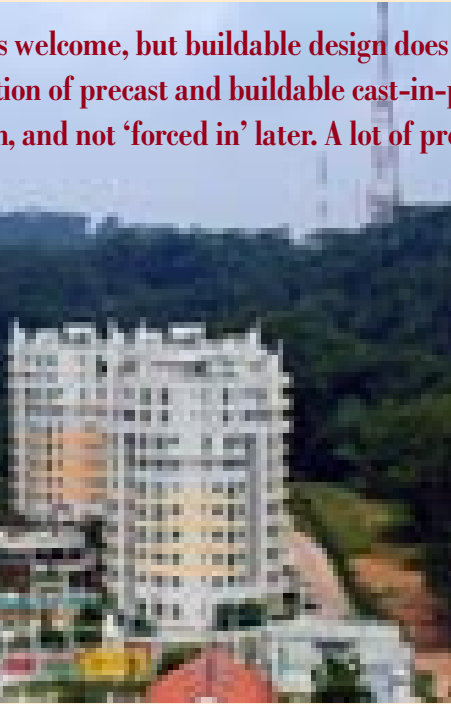
The setting of the typical block was used as the base for the mould and planning of other precast elements. Variations from which were then developed to generate the variant types of precast element. Effort was put to standardise the design details and the various dimensions, especially setting out of the curvilinear external façade so that the moulds could be reused in the two non-typical blocks. The elevation radius curvature is standardised to only four dimensions of 6 m, 7.5 m, 12.5 m and 23.5 m.

The types of precast elements adopted in this project include precast prestressed plank for 50 percent of the residential floor; precast façade elements, both curved and flat; precast trellis; precast balcony and planter box; precast stair flight; and precast roof top feature wall.

All these precast elements are integrated into the conventional in-situ beam and column frame structure construction through collaboration with the structural engineer to ensure a good fit in rebar positioning during the erection of the precast elements. This construction method cuts down material han-

...s welcome, but buildable design does not have to be all
 ...ion of precast and buildable cast-in-place design. Precast, if
 ...n, and not 'forced in' later. A lot of pre-planning is needed."

- Richard Lai



...ion of a flower.



Precast picturesque crown pediment.

...dling requirement and is easy to install. The precast elements need only simple touch up after installation.

The use of precast elements for the curve façade, balcony and features in the building elevation has ensured good and consistent quality of the final finished work.

Traditional brick and plastering works have been known to create uneven or wavy surface finish and adoption of which may compromise the overall aesthetics of the completed works. It also presents possible crack problems in the future. The use of steel mould precast method addresses these issues successfully.

All the precast concrete elements are designed as critical elements, which must be installed prior to the casting of the horizontal floor structure. This ensures better water tightness performance compared to a non-critical 'clad-on later' type of construction.

The precast façade panels are semi-structural elements. The perimeter floor beams are incorporated into the precast façade panels, which are then connected to the in-situ columns, and thereafter cast in concrete after the laying of the beam top rebars that are laid

on site. The wall panels abutting the in-situ columns also act as permanent formwork, which requires the setting in of the column position along the perimeter of the building.

The precast balcony and planter box elements are designed as cantilevered slab structures which are connected to the building through the introduction of projecting long starter rebars in the in-situ slab of the floor structure. All joints between the precast elements are then grouted with non-shrink grout and touched up with polymer cementitious material giving the building a seamless external look.

Precast stair flights, parapet and roof top feature walls are designed with loop stirrup reinforcement for both horizontal and lateral in-situ connection to control crack and water seepage through the connection area.

The floor slabs are of composite construction using precast prestressed 80 mm thick plank and in-situ topping concrete to give an overall slab thickness between 150 mm to 200 mm. Full propping has been provided to the plank during the floor construction for better alignment of joint and control

of camber differences of adjoining panels. This arrangement has not only eliminated the use of temporary formwork but also speeded up the construction floor cycle time delivering a smooth soffit.

The project allowed the Design and Build team to experience new opportunities in design and construction integration, enhancing the design and cost efficiency. The close collaboration and detail design co-ordination among the multi-disciplines designers, the manufacturer and the contractor has led to the expansion of the knowledge base and awareness of innovative design and construction solutions.

Project Team

Client: Anchor Development Pte Ltd

Architect: ADDP Architects

C & S Engineer : Hainal-Konyi (S) Pte Ltd

M & E Engineer: United Project Consultants Pte Ltd

Quantity Surveyor: Davis Langdon & Seah (S) Pte Ltd

Contractor: Santarli Construction Pte Ltd

Precaster: Excel Precast Pte Ltd

System efficient house

By William Lau and Yap Kin Fung
A. Alliance Architects Pte Ltd

A. Alliance Architects believes that an integrated environmental approach to the construction of landed housing is desirable and feasible. Together with Pacific Prince International, it has constructed a lightweight system efficient house at Upper Changi Road East that is practical, cost efficient and environmentally friendly.

Conventionally, landed houses are built using reinforced concrete and bricks. This method is not only expensive and labour intensive, but also wastes an excessive amount of scarce building materials such as timber.

Moreover, due to the frequent need to upgrade info-com and high-tech M & E services, hacking of brick walls and reinforced concrete frame to embed these services have become laborious and expensive.

The lightweight system efficient method of construction has several significant advantages over traditional reinforced concrete construction.

The System Efficient House is constructed from panels of galvanised steel channels, cement boards and steel roofing sheets. Riveted together, these elements form a very strong and yet light steel shell. The shell can then be clad with normal architectural

The System Efficient House is constructed from panels of galvanised steel channels, cement boards and steel roofing sheets.



The completed house.

finishes, such as cement and timber boards, stone claddings, etc.

A cost estimate indicated that

if the technique was applied on a larger scale, such as five houses onwards, the cost savings would be significant. This is due to the high level of prefabrication and mass manufacturing inherent in the process and, of course, to the faster speed of construction.

Time and cost savings

There was significant cost savings as the project involved shorter construction period due to the high level of prefabrication or factory production. Piling was not required as the structure is lightweight. Faster M & E installation, faster architectural finishing work and reduced labour requirements meant lower costs too. The shorter construction period led to greater rental savings as well.



Close-up of the second storey prefabricated structure.



The lightweight steel panels were prefabricated in the factory.

Reduced pollution

As there is less construction debris and major components are prefabricated in factories, pollution was greatly reduced. There was also minimal disturbance to neighbours as piling was not required.

Prefabrication

Using prefabrication meant lightweight materials, dry and hollow construction, standard off-the-shelf system, and inexpensive fabrication moulds. Most components could also be handled without cranes and pulleys.

Design flexibility

There is considerable flexibility in the design as the final outlook can be clad with normal architectural finishes. The short intervals of steel frame gave maximum flexibility and there was ease of future spatial reconfigurations and modifications.

Ecology

The house is designed to incorporate as many ecological considerations as possible. The passive ecology concerns include low energy and labour usage, well insulated building structure and maximum environmental fit. The active ecology concerns include natural elements such as rainwater and solar energy that could be captured for good usage.



Project Team

Client/developer: Pacific Prince International

Architect : A.Alliance Architects

C & S Engineer: SKC & Associates

Steel Fabricator: BHP Steel Building
Product (S) Singapore Pte Ltd

Prefabrication getting popular in Singapore

By Danny Tan
Technology Development Division, BCA



Prefinished sandstone façade at St Anthony Primary School.

In recent years, the local precast sector has developed strong capabilities, especially in the areas of detailing for connections and aesthetics, making precast construction a viable option for private property projects. Recently, there have been several developments within the precast sector,

some of which were initiated by the government agencies while various upgrading activities have been embarked on by the precasters to remain competitive.

Technical capability

The progressive precasters have been showing great interest to develop their technical competency. They have set up technical teams to provide precast design, supply and install services to their clients which gives them an edge over their competitors. For example, Eastern Pretech Pte Ltd has been leveraging on its design capability to provide value added services to its clients. Other firms such as Fermold Pte Ltd, Hong Leong Asia Ltd, Excel Precast Pte Ltd and Hua Kok Precast Pte Ltd have also developed their precast design capabilities.

Architectural prefab components

Until now, architects were limited to the use of plaster and paint, stone cladding, glass and aluminium curtain walling systems for the façades of a building. Architectural precast has unleashed a totally new range of finishes for architects including a vibrant range of texture and coloured finishes.

Architectural pre-finishes

Two precast firms, Fermold Pte Ltd and Precast Technology Pte Ltd have carried out studies to develop architectural pre-finishes for precast external walls, such as coloured panels, exposed aggregates and reconstructed stone. More finishes are expected to be developed to provide a wider variety of architecture precast concrete to meet the architect's needs.



Polished reconstructed stone façade at the E-Centre.



Steel columns and colourful façades were used in a Seletar Hills terrace house.

These two firms have in fact piloted the use of these newly developed pre-finished panels in their projects, one of which was a terrace house in Seletar Hills by Fermold. In this project, stained colour precast façades were used for the external walls.

Another firm, Redland Precast Pte Ltd has also used pre-finished sandstone external façades for a primary school, namely St Anthony Primary School.

Landed housing

Practical, cost effective and environment friendly- these are the attributes of a prefab system that was used to construct a terrace house along Upper Changi Road East. Lightweight but strong steel sections were used in the construction of this house. Steel sections were also used as columns for the Seletar Hills terrace unit. Other landed residential developments that used structural steel frames are a pair of semi-detached houses at Tavistock Avenue, an intermediate terrace unit at Still Lane and a two-storey house at Jalan Batai. The use of steel members for the construction of residential units will likely be a trend in the future as local designers and clients realise its benefits.

Simulated rock finish.



Pre-finished colour panels.



Prefab household shelter

The amount of reinforcement needed for a household shelter is tremendous. Constructing a household shelter takes more than twice the amount of time needed for a conventional slab or wall system. Hence, precast household shelter is an excellent solution to speed up the construction progress. A study was done by BCA, together with industry players, to use precast household shelters for private residential projects. Thus new precast household shelter designs have been developed for landed properties and condominiums.

New material

To remain competitive, it is imperative for the local precast industry to embrace new and innovative precast ideas. A team from NUS in collaboration with private firms undertook an R&D project to develop high strength lightweight concrete. This lightweight concrete can be used for non-load bearing components such as internal walls in place of brickwalls.

Multi level production facilities

For a long time, precast production has been a land intensive operation. Single storey production and storage areas were built, taking up much valuable land. However, over the last few years, precasters have been exploring more efficient ways to utilise their land and automate their production facilities.

The Prefabrication Technology Centre (PTC), the R&D arm of the Housing and Development Board was quick to fully exploit the advantages of a multi-level precast production and storage concept with automated production facilities. Fermold Pte Ltd will also be building a multi-storey precast plant with advanced production system. Syscon Pte Ltd is also planning to construct a 10-storey production plant comprising four levels of production floors at Tuas Bay.

Increase in demand

The demand for the precast industry is looking good in the next few years as the industry moves towards more buildable design. Demand from the public sector is expected to take the lead, with the private sector narrowing the gaps in adopting prefabrication technology. During the past four years, there has been an increase in the number of precast projects in the private sector. This shows that more designers and builders are adopting prefab construction for their projects in meeting their quality and productivity targets.

BCA, on its part, will continue to promote a large role in promoting prefabrication and other buildable designs to the industry. And in time to come, going prefab will become a natural way of construction for local designers and builders.



The Prefabrication Technology Centre (PTC).

Artist's impression of Fermold's factory.



	1999	2000	2001
Volume of concrete used in precast as a percentage of total concrete volume	7.0 %	7.5 %	7.4 %

Precast level in Singapore.

Cost effective solutions for client and contractor

Kimly Construction Pte Ltd has completed a large number of building projects, ranging from public projects to private projects, including building maintenance. To date the company has attained A1 category with BCA. With its vast resources and experiences in construction and project management, Kimly is now intensifying its expertise in the field of precast construction to move to the forefront locally and overseas.

Why precast?

Precast systems can provide cost effective solutions for both the client and contractor, and to be competitive in today's situation.

The use of an in-house design team can provide design and feasibility solutions on the type of precast elements to enhance productivity and efficiency, and to phase out old methodology or conventional method of construction. Using precast system also improves the quality of final products.

Track Record

As part of its growth, Kimly has been utilising precast technology as one of the key construction methods in some of its current projects:

The Teneriffe, a private cluster housing development, was originally designed as an in-situ project. After being awarded the project, Kimly proposed precast method for the construction in view of the regular grid and simplicity of the design.

Sanctuary Green, a private condominium project was originally designed as a conventional in-situ project with external brickwall and plastering. However, Kimly proposed precast panels for its external façade to speed up the erection process and the completion of the building envelope.

The Kerrisdale, a private condominium project uses precast system for its external walls and internal walls.

Advantages

According to Kimly, using precast systems mean an increase in buildability score; an increase in the quality of the final product; an improvement in the site productivity and work methods; enhanced site safety as the site is cleaner; fewer workers and less scaffolding; less noise; better housekeeping; and better materials wastage control.



Precast façade panel casting operation.



Back view of precast system.

Front view of precast system.

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Excel Precast for a buildable design solution

Excel Precast Private Limited (Excel) was set up in 1999 with the objective of providing the industry with precast concrete technology solutions. It is engaged in the design, production and delivery of precast concrete elements. Its management staff are qualified and experienced professionals in precast technology.

Its key functional departments include an in-house technical and design department using the latest computer software for their design and drafting function; a product development and marketing department; and an operational department in charge of production, quality management and delivery.

New factory

Excel will have a two-storey new factory building with modern manufacturing facilities by 2003. It can then produce about 40,000 cubic metres of precast concrete products.

Currently operating from two open-yard facilities at Tuas South and Kranji, it produces 2,500 cubic metres per month or 30,000 cubic metres a year. Its annual turnover has been growing since its inception and its book order is currently at over \$35 million.

Excel's future plans are to diversify into more building products such as the lightweight partition wall and unitised bathroom when the market demand matures. Design and Build projects which



The Petals is another architectural precast success for Excel Precast.

are gaining popularity, will also be the main growth sector for Excel. It has expertise in buildable solution and value-added services for projects with interesting and challenging features. Excel is developing its capability to capture this niche market.

Track record

Since its inception, Excel Precast has secured thirty-six precast supply contracts covering a wide range of precast concrete components.

Some completed projects in its track record included the up-market condominium at 38 Draycott Drive, The Petals at Hillview Avenue, The Euphony at Sembawang; and schools projects like the Greenwood Primary School and the Christchurch Secondary School. Its other major client is the Housing and Development Board, with whom it has secured five term contracts for the supply of precast household shelters, lift shafts and various other elements in public housing developments.

Excel has established a track record of performance in the industry, and is actively promoting buildability through precast concrete technology.

Excel's precasting facilities at Tuas South Avenue 1.



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Tiong Seng going places

Tiong Seng Contractors (Pte) Ltd is a multi-faceted construction company managed by an efficient and forward looking team. It started with engineering contracts in 1959. Since then, the company has grown from strength to strength with each project, always looking for continuous improvement and diversifying into new areas. The company recently achieved the Singapore Quality Class status and has spread its operations to Asian countries such as China, Papua New Guinea, Laos and Vietnam.

Tiong Seng is classified as Class A1 in the Civil Engineering and General Building category under BCA's new contractor's registration system.

The company has been actively involved in the precast system, from the design concept to installation. It has been applied in a number of schools, condominiums, institutions and landed housing projects. It has not only increased productivity remarkably, but also improved buildability and the quality of its buildings.

Track records

The company started exploring precast systems and using precast components way back in 1989 at the Senoko Incineration Plant project. In this project, the roof beam and slab, at 45 metre height, were converted from cast-in-situ to precast.

For the Siglap and Queenstown Secondary School projects, Tiong Seng designed and detailed standardised precast components for elements of the building that were repetitive, labour and time intensive. These projects were awarded the BCA Best Buildable Design Awards 1999. Other projects in which it has applied its expertise in precast technology include Bedok Green Secondary and Corporation Primary Schools.

The company has also adopted the precast concepts on various building elements in the recently completed condominiums such as Guilin View, Yew Mei Green and Rivervale Crest. In the ongoing Park Green Executive Condominium, a design and build project, it has initiated the precast system for the superstructure to achieve high buildability and quality.

At the Goldenhill Villas project, Tiong Seng is working on the structure from the first storey to the roof which is precast for the wall, beam and slab elements.

Expertise

As the use of precast system for landed housing is relatively new in the industry, the company has assembled the required expertise and conducted in-depth studies on the details for fabrication and installation, with the objective of maximising the benefits of the precast system.

Tiong Seng is actively pursuing precast technology for its ongoing and future projects. It also aims to increase its knowledge by participating in the activities relating to precast technology organised by BCA and other authorities and associations.



Precast elements installation at Bedok Green Secondary School.



Site precasting yard for beams at Corporation Primary School.

Precast works at Goldenhill Villas.



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Prefab architecture - a trend with a bright future

Dave Walker, Commercial Director at Trent Concrete, UK describes some projects in the UK that used prefab architecture to achieve aesthetic results.

Hybrid concrete construction at new Toyota HQ

Hybrid concrete construction, the combined use of precast and in-situ concrete, delivers considerable benefits in terms of aesthetics, function, speed of construction, buildability and safety. The new Toyota (GB) headquarters in Surrey provides an excellent illustration of how these principles work in practice.

The client's brief for the new Toyota (GB) headquarters at Great Burgh, near Epsom in Surrey was that the building should be flexible in its use whilst maintaining a low energy concept. The architects Sheppard Robson's design is based on four two-storey office wings radiating from a glazed 'street' which houses all communal facilities and connects to an entrance rotunda.

The office superstructure is an ingenious hybrid concrete structure, designed by Whitby Bird & Partners.

The Toyota (GB) headquarters office superstructure provides an excellent illustration of the benefits of hybrid concrete construction.



Large open office spaces were created by the structural steel stanchions incorporated within the precast columns, removing the need for shear walls.

Trent Concrete's precast concrete encased steel columns and sculptured floor soffits combine with in-situ concrete continuous spine beams and floor screed, with in-situ concrete 'stitches' hidden from view by the precast. Lateral stability is provided by the structural steel core of the precast columns, which enable an open-plan design concept that is achieved by removing the need for internal shear walls.

The circular white reconstructed stone two-storey columns were cast as one unit and typically measure 8 metres in height by 450 millimetres in diameter, and the matching floor panels measure 3 metres by 6 metres. Both were cast in fibre-glass lined moulds to produce the high quality, smooth finish which could be left exposed to maximise the concrete surface's thermal capacity.

This thermal mass is exploited to provide passive cooling, whereby the concrete absorbs heat during the day, enabling the air conditioning load to be minimised. The high-quality ex-mould finish at Toyota also eliminated the need for decoration, which in addition to enhancing the thermal flywheel effect

also saves further trades and reduces maintenance costs over the lifetime of the building.

Trent worked closely with the architect and engineers on an intensive design development process to finalise the coffer shape. This involved a full-scale polystyrene pattern, which was modified until the design intent could be accurately achieved through precast manufacture. Absolute attention to detail was also required in the design of the steel reinforcement cage to accommodate the thin shell and shear connections.

A special casting gantry was built adjacent to Trent's storage area to enable the columns to be cast vertically. Access platforms were erected at strategic levels providing safe access for assembly and guaranteeing dimensional accuracy throughout the casting process.

The Toyota (GB) development demonstrates how hybrid structures provide a practical way of achieving construction efficiency objectives in terms of better value for money, fewer defects, greater certainty, faster construction time and increased safety.

Precast cladding for Thames Water HQ

Concrete was selected as the primary construction material for Clearwater Court, Thames Water's new HQ in Reading. The building features a partially exposed in-situ concrete frame and reconstructed stone precast concrete cladding. In total, 19,000 tonnes of concrete were used.

Clearwater Court is located on the South bank of the River Thames, next to Reading Bridge. The five-storey building is formed by two crescents linked by a central glazed atrium, with helical stairs in glass tubes at the end of each wing.

The benefits of both in-situ and precast concrete, in terms of construction efficiency, quality, value for money and sustainability, were fully exploited to produce an excellent working environment and an aesthetically pleasing, prominently located, building.

Trent Concrete's reconstructed stone cladding is a focal point of the building, and fulfils the client's requirements for a robust, unostentatious design. The radiussed elevations of the façade are in mullion and spandrel format, featuring extensively up to four floors and at roof/plant room level. The façade panels have been designed with rebated joint lines to reflect the lines of the floor slab behind them, and to modulate the plainness of the surface.

Other sections, such as cores to the atrium and end lift shafts, adopt a wall panel scheme with false joints to replicate the spandrel and mullion features, and achieve aesthetic continuity. In total, 5,700 square metres of light Portland Stone coloured cladding, with a flawless rubbed surface finish, was produced.

The precast solution was chosen as the preferred option following a detailed value engineering exercise carried out by the management contractor and professional team.



Precast cladding was selected for its buildability advantages, which were particularly important at this tight site.

Precast was favoured because of its buildability advantages, with finished units being delivered to site on a just-in-time basis for rapid erection. This was particularly relevant given the tight site, located between the bridge, river and road. Factory-controlled conditions also ensured the quality and accuracy required for such a landmark building.



The benefits of both in-situ and precast concrete were fully exploited at Thames Water's new HQ in Reading.

Architectural GRC at The Mailbox



Buff-coloured GRC cladding on Wharfside street matches the reconstructed stone cladding on the front elevation of The Mailbox in Birmingham, UK.

Trent also recently completed an architectural GRC cladding contract at The Mailbox in Birmingham. The Mailbox, created from the former Royal Mail sorting office, is now a large mixed-use residential, retail, office, leisure and hotel development.

The front elevation is partially clad in 600 square metres of acid-etched reconstructed stone cladding. This forms the façade of the four-star Malmaison Hotel, with a large entrance portal leading into the open-air up-market Wharfside Street retail/office area and

Credits

Toyota HQ
Client: Toyota (GB) PLC
Services Engineer: Ove Arup & Partners
Project Manager: Insignia Richard Ellis
Structural Engineer: Whitby Bird & Partners
Architect: Sheppard Robson
In-situ Concrete: Duffy Construction Ltd

Thames Water HQ
Project Manager: Ridge Management
Architect: Barton Willmore Partnership
Management Contractor: Sir Robert McAlpine
Structural Engineer: Sinclair Knight Merz
Service Engineer: Donald Smith Seymour
Rooley Substructure & Frame: PC Harrington

The Mailbox
Client: Birmingham Mailbox Ltd
Architects: Associated Architects & Weedon Partnership
Contractor: Carillion Building
Engineer: Curtins

pedestrian link-way. Here, the 1,400 sq m of buff GRC cladding matches the precast stone work on the façade, but solved access and craneage challenges through its lightweight, manoeuvrable qualities.

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