


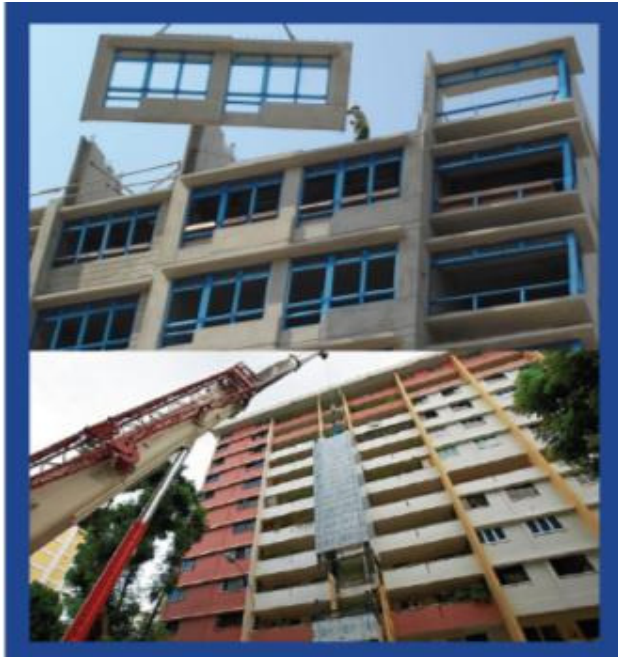
Annex D
Construction Productivity Award – Advocates

| No. | Company | Key Productivity Initiatives |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p>City Developments Limited</p> <p>Developer Category Platinum</p>  | <p>Key Productivity Initiatives</p> <ul style="list-style-type: none"> • The adoption of the prefabricated bathroom units (PBU) in CDL’s residential developments is one of their key productivity initiatives. The use of PBU improved construction productivity by about 77%. It also reduced construction waste while improving water tightness of the bathrooms. To date, CDL has installed close to 8,000 PBUs in their residential developments. • CDL has pioneered the adoption of drywalls since 2000. Drywalls are easier to install, less labour intensive and provide a better quality finish when compared to the traditional brick wall. To date, CDL has constructed and handed over more than 7,000 residential units with drywalls. • Since 2011, CDL has kickstarted the adoption of Building Information Modeling (BIM) during the planning and construction phase of their projects. The use of BIM helped facilitate better team work among the consultants and builders to improve the overall productivity, safety and quality of the projects. The Quayside Isle was the first project by CDL that was designed using BIM. Since then, all new projects by CDL have adopted BIM in their design and construction phase. • CDL has also inculcated productive construction methods in their builders. These include the “No external scaffold” and “No struts to basement’ methods, which are more labour efficient, easier to construct and provide a better quality finish. |

2

Housing & Development Board

Developer Category
Platinum



- The HDB Construction Productivity Framework is a three-stage approach to drive productivity at pre-construction, construction and post-construction stages.
 - One initiative during the pre-construction stage is the use of Building Information Modelling (BIM). It allows all parties of a project to communicate via a common platform, thus reducing construction conflicts upfront during the design stage.
 - At the construction stage, HDB requires their builders to make use of more productive equipment.
 - During the post-construction stage, HDB reviews design guidelines, materials, construction details and methods based on feedback from residents. Lessons learnt will be used to improve the design and construction of future projects.
- HDB has advocated the use of precast technology since the 1980s. Examples of precast building components include precast façade with cast-in windows, columns, floor slabs, staircases and refuse chutes. In recent years, HDB further optimised the use of precast components coupled with large panel system formwork. The optimization enabled them to achieve higher productivity gains.
- Under the Lift Upgrading Programme (LUP), the use of steel structure with aluminium cladding for the lift shafts was introduced in 2007. As the steel lift shafts weighed only a fraction of the conventional RC shafts, a longer section of the shaft could be hoisted each time, thus improving the efficiency of the hoisting operation. In addition, the use of steel shafts eliminated the need to grout different sections of the lift shafts thereby saving time and manpower. Machine roomless lifts were also designed such that most of the components could be placed within the shaft containing the lift car. As no machine room was required, there was a reduction in construction time and cost.

3

Chip Eng Seng Contractors (1988) Pte Ltd

Builder (Open) Category
Gold



- Chip Eng Seng Contractors advocates the use of precast concrete components extensively in their projects. This would minimise the in-situ structural works on site and reduce the reliance on foreign workers. The firm has even set up their own precast yard to produce a wide range of precast components. The first precast yard was set up in Tampines in 2003 while a second yard was set up in Senai, Malaysia in 2010.
- Since 2007, the firm has adopted the use of system formwork including table form, jump form and aluminium form in their projects to improve productivity.

4

ADDP Architects LLP

Consultant Category
Merit



- ADDP Architects is equipped with the experience and knowledge in designing buildable systems such as the prefabricated bathroom units (PBU) and drywalls in their residential projects. The buildable design score for projects like Parc Emily, Wilkie Studio and Cliveden @ Grange were 88, 84 and 86 respectively.
- The firm also actively shares knowledge with the industry through seminars and contributes articles to different publications.

5

Kimly Construction Pte Ltd

Builder (Open) Category
Merit



- The on-site precast yard was strategically set up in the Sengkang N4 C16 project to eliminate the transportation of precast components from the factory to the site. Approximately 30% of the precast elements were cast in the on-site precast yard. The just-in time approach was used during the installation process to minimise the storage space of the precast components.]
- The firm also adopted BIM in the Tresalveo project to simulate the construction schedules and detect clashes between mechanical and electrical (M&E) services. This reduced the number of re-works and improved the productivity on site.

6

DLE M&E Pte Ltd

Builder (Prime) Category
Merit



- With co-funding from the Mechanisation Credit (MechC) Scheme, DLE purchased scissor lifts to improve the efficiency of electrical conduit installation. This method has since replaced the traditional method of erecting scaffolds which is highly labour intensive.
- DLE also placed great emphasis on training and upgrading the skills of their workers. The firm has successfully utilised the Construction Productivity & Capability Fund (CPCF) to help subsidise the training cost

Construction Productivity Award – Projects

Tiong Seng Prefab Hub

Platinum Award

(Industrial Buildings Category)



| | |
|--------------------------|-----------------------------------|
| Architectural Consultant | Look Architects Pte Ltd |
| Structural Consultant | LSW Consulting Engineers Pte Ltd |
| Builder | Tiong Seng Contractors (Pte) Ltd |
| Client | Robin Village Development Pte Ltd |
| Construction Cost | \$12,000,000 |
| Gross Floor Area | 19,813.11 m ² |

Tiong Seng Prefab Hub is a 5-storey single-user general industrial building (Precast Factory) with ancillary concrete batching plant and temporary workers' dormitory at 63 Tuas South Avenue 1 (Tuas Planning Area).

Key Features:

- High volume of precast was incorporated in the construction, hence reducing in-situ casting and increasing productivity. Double tee slab was used at every level instead of in-situ slab, which helped in reducing manpower, time, cost and risk of working at height.
- ST100 shoring system was used to support main beams weighing 32 tons. This eliminates the need to dismantle and re-erect traditional scaffolding if there is a change in location, hence reducing manpower and improving productivity.
- Peri's RCS Climbing System was used for all staircases and lift shafts. This sped up processes and helped to achieve better quality off-form finishes.
- Steel Fibre Reinforcement Slab was used instead of welded mesh in the construction of the external driveway. This helped to reduce manpower, time and cost.
- Precast elements and advanced formwork system were used to achieve off-form finishes. The project also used dust free grinder, which is handy and easy to use, to achieve better productivity and quality.

CPA – Projects

ITE Headquarters and ITE College Central @ Ang Mo Kio

Platinum Award

(Institutional Buildings Category)



| | |
|--------------------------|-----------------------------------------------|
| Architectural Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Structural Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| M&E Consultant | Squire Mech Pte Ltd |
| Builder | Kajima Overseas Asia Pte Ltd |
| Client | Institute of Technical Education |
| Construction Cost | \$394,050,000 |
| Gross Floor Area | 192,820 m ² |

The 8-Storey ITE College Central and Headquarters comprise an administration block, four school blocks, three workshop blocks, an aerospace block and a sports block.

Key Features:

- Extensive use of precast and prefabricated elements helped the project achieve high construction productivity. There was minimal use of labour which resulted in reduction of labour cost. Elimination of formwork and staging also produced a clean and safe working environment.
- Drywall construction was adopted to achieve faster construction timeline and superior quality control. The minimal wet trades on site resulted in on-site energy conservation and less wastage.
- The use of system formwork greatly reduced the time and manual labour involved in setting and striking the formwork. Large areas of slab were simpler, faster and safer to form.
- Modular system comprising steel lintels and stiffeners replaced the traditional use of reinforced concrete stiffeners which resulted in the easier installation. This saved time and manpower.

CPA – Projects

VoLaRi

Platinum Award

(Residential Non-Landed Buildings Category < 25,000 m²)



| | |
|--------------------------|----------------------------------|
| Architectural Consultant | Architects 61 Pte Ltd |
| Structural Consultant | KTP Consultants Pte Ltd |
| M&E Consultant | Squire Mech Pte Ltd |
| Builder | Tiong Seng Contractors (Pte) Ltd |
| Client | City Developments Limited |
| Construction Cost | \$65,000,000 |
| Gross Floor Area | 16,675.80 m ² |

VoLaRi is a condominium housing development comprising one block of 12-storey residential units with a basement carpark, swimming pool and communal facilities.

Key Features:

- Improved productivity was achieved by using full precast envelop system. The external walls with full precast components eliminated the need for scaffolding which was time consuming and laborious.
- The project was able to achieve a 7-day per floor cycle consistently hence easing space constraint on site in having to stock up materials required for conventional wet work. This also helped keep the site tidy and clean.
- An advanced System Formwork, Peri's Skydeck system, was used for slab construction and Peri's SRS Steel Formwork system was used for the vertical components. This cut down on construction time and reduced manpower.
- Dry wall partition was used for most internal walls. They can easily be installed, hence required less labour.
- Prefabricated bathroom units (PBU) were installed in this development resulting in a reduction in construction time.
- Conversion of common reinforced concrete staircase to steel staircase allowed the staircase to start its modular production prior to the construction of RC structural wall. This helped to shorten the time needed to construct the structure and eased the carpentry manpower for precast yard.
- The "one push-press fitting technology" was adopted in this project. This system does not require any tools during installation. It only requires a press-to-fit action to secure the water pipes, thus reducing manpower. Lesser space was also needed for storage.

CPA – Projects

Replacement of 14 Numbers of Fixed Gangway at Terminal 2, Changi Airport

Gold Award

(Additions & Alterations / Upgrading Buildings Category)



| | |
|--------------------------|-----------------------------------------------|
| Architectural Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Structural Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| M&E Consultant | Squire Mech Pte Ltd |
| Builder | Takenaka Corporation |
| Client | Changi Airport Group (Singapore) Pte Ltd |
| Construction Cost | \$23,925,716 |
| Gross Floor Area | 1,700 m ² |

Fixed gangways are bridge buildings that connect the terminal building and docking aircrafts at second storey. This project involves the replacement of 14 fixed gangways with dimensions of approximately 32m (L) x 3.15m (W) x 2.8m (H).

Key Features:

- Repetition of design module and modularisation of steel truss enabled standardisation of member size, length and connection details. Standardisation streamlined coordination, fabrication and reduced wastage. It also improved speed of construction.
- Extensive pre-fabrication was adopted in this project. Pre-fabrication at the off-site yard helped to achieve better coordination control to meet tight construction schedule.
- Steel members were assembled at an off-site yard and this allowed only simplified construction on-site that substantially reduced the use of material, temporary works and manpower needed. Minimised on-site installation and temporary works also reduced the disruption of airport operation.

CPA – Projects

Punggol Green Primary School

Gold Award

(Institutional Buildings Category)



| | |
|--------------------------|----------------------------------|
| Architectural Consultant | ID Architects Pte Ltd |
| Structural Consultant | DE Consultants (S) Pte Ltd |
| M&E Consultant | AECOM Singapore Pte Ltd |
| Builder | Lian Soon Construction Pte Ltd |
| Client | Ministry of Education, Singapore |
| Construction Cost | \$24,966,500 |
| Gross Floor Area | 19,984.36 m ² |

Punggol Green Primary School is a new primary school commissioned by the Ministry of Education, comprising two blocks of 5-storey teaching facilities, one block of multi-purpose hall and one block of indoor sports hall with canteen at Punggol Field/ Punggol Walk.

Key Features

- The project adopted the modular concept, repeats in its structural grids, opening and services core. This concept allowed systematic repetition of a typical layout from floor to floor. Modular size was adopted for ease of construction, thus resulting in savings in time and manpower.
- Extensive use of precast concrete was adopted to hasten the construction speed and enhance its buildability. The classroom blocks were fully precast including the first storey and roof. The extensive use of precast elements such as precast columns, beams, hollow core slab, planks and staircases resulted in less labour requirement, improved safety, quality and higher productivity.
- The use of precast external facade walls instead of brick wall system helped to reduce the construction cycle and improve the water tightness of the building envelope.
- Internal drywall system in lieu of conventional brick wall helped to ease construction and reduce wet trades on site, thereby increasing the efficiency and speed of construction. This also resulted in higher quality finish, faster installation and better housekeeping.
- Building Information Modelling (BIM) was adopted in this project to better visualize building details and detect clashes to avoid abortive work. The team had a clearer overall vision of the project and was able to firm up decisions quickly.

CPA – Projects

Punggol East Contract 21 (Punggol Spring)

Gold Award

(Residential Non-Landed Buildings Category $\geq 25,000 \text{ m}^2$)



| | |
|--------------------------|-----------------------------------------------------------------------|
| Architectural Consultant | Surbana International Consultants Pte Ltd |
| Structural Consultant | Surbana International Consultants Pte Ltd |
| M&E Consultant | Surbana International Consultants Pte Ltd |
| Builder | Qingjian International (South Pacific) Group Development Co., Pte Ltd |
| Client | Housing & Development Board |
| Construction Cost | \$99,960,000 |
| Gross Floor Area | 61,964.50 m ² |

Punggol East Contract 21 (PEC21), also known as Punggol Spring, is located at the junction of Punggol Drive and Edgefield Plains. It comprises five blocks of 17-storey residential blocks, one multi-storey carpark with electrical sub-station, and one precinct pavilion.

Key Features

- The full precast system simplified the construction as it provided standardisation and repetition of precast components for every storey. Thus, lesser manpower was needed resulting in an increase in productivity. The off-site production of precast components also resulted in better quality finishes.
- Steel lift frames and aluminium cladding system were used for the construction of lift shafts. The steel frames were fabricated off-site and pre-assembled to 2-cores steel frames before being delivered to site. The installation of steel lift frames in 2-storey duplex modular section by means of bolts, nuts and welding reduced the construction time on site. It also contributed to the ease of construction and improved productivity.
- The Bioswales system, an environmentally friendly system, was adopted in the project. It takes on the cleansing function by treating storm water through fine filtration and improve water quality. It is a self sustaining system that requires minimal maintenance.

CPA – Projects

The Peak @ Toa Payoh

Gold Award

(Residential Non-Landed Buildings Category $\geq 25,000 \text{ m}^2$)



| | |
|--------------------------|----------------------------------------|
| Architectural Consultant | JGP Architecture (S) Pte Ltd |
| Structural Consultant | BC Koh & Partners LLP |
| M&E Consultant | J Roger Preston (S) Pte Ltd |
| Builder | Straits Construction Singapore Pte Ltd |
| Client | Hoi Hup Sunway J.V. Pte Ltd |
| Construction Cost | \$293,587,318 |
| Gross Floor Area | 126,931.12 m ² |

The Peak @ Toa Payoh is a public housing development comprising two blocks of 42-storey residential flats with sky terrace at the 22nd storey and three blocks of 40-storey residential flats. It is located at Lorong 1A Toa Payoh.

Key Features

- Extensive use of precast components which were cast off-site, and delivered to the worksite prior to installation. The extensive use of precast planks had enabled the slabs to be cast with minimal formwork, saving considerable time in the construction of the superstructure.
- An identical and mirror image unit layout was adopted for the entire elevation of each building block. Due to the simplified design, the types of precast moulds and material required for the fabrication of mould were also reduced. Moreover, manpower and potential errors during construction were also minimised.
- Precast internal partition walls were used in this project instead of the conventional brick walls. The method of installation of the precast partition walls is a cleaner and faster alternative that requires only bedding material and welding works for the connection joints. Manual transportation of bricks to the units was thus eliminated, resulting in reduced labour cost and time.

CPA – Projects

Woodlands N2C12 (Straits Vista)

Gold Award

(Residential Non-Landed Buildings Category $\geq 25,000 \text{ m}^2$)



| | |
|--------------------------|-------------------------------------------|
| Architectural Consultant | Surbana International Consultants Pte Ltd |
| Structural Consultant | Surbana International Consultants Pte Ltd |
| M&E Consultant | Surbana International Consultants Pte Ltd |
| Builder | Ho Lee Construction Pte Ltd |
| Client | Housing & Development Board |
| Construction Cost | \$63,970,000 |
| Gross Floor Area | 53,437.36 m ² |

Woodlands N2C12 (Straits Vista @ Marsiling) is located in Woodlands, fronting Marsiling Lane. The development comprises two 30-storeys and one 26-storey residential blocks with 382 units of 3 and 4-room flats, complemented by a generous central green space filled with varied amenities and a 4-storey multi-storey car park.

Key Features

- Most of the structural vertical columns and walls for the project were designed as precast solid components which eliminated the reliance on labour intensive and time consuming erection of external scaffold, external formwork and platform system.
- Part of the main water pipe was fitted with stainless steel press-fit fittings to prevent leakage at the joints. Press-fit fittings use clamping technology, thus are easier to install.
- Ferrolite lightweight partition panels were used in most areas, except wet areas, to increase productivity due to its fast, easy and economical installation without compromising integrity and insulation performance.