The Construction Productivity Awards (CPA) recognise outstanding industry firms for going the extra mile to achieve construction productivity improvements and promote higher productivity in the industry.

The CPA – Projects is awarded to project teams that have demonstrated productivity in their projects from the design to the end of construction. The award aims to:
- Encourage designers to come up with labour-efficient designs;
- Encourage the adoption of labour-efficient construction methods; and
- Recognise project teams for their excellent project planning and coordination in enhancing productivity.

The award has nine sub-categories:
- Residential Landed Buildings
- Residential Non-landed Buildings (for projects with Gross Floor Area of less than 25,000m²)
- Residential Non-landed Buildings (for projects with Gross Floor Area of more than or equal to 25,000m²)
- Commercial and Office Buildings
- Institutional Buildings
- Industrial Buildings
- Mixed Development Buildings
- Additions & Alterations / Upgrading Buildings
- Civil Engineering Projects
AMBER SKYE
Residential Non-Landed Buildings Category < 25,000m²

CONSTRUCTION PRODUCTIVITY AWARD – PROJECTS | PLATINUM

KEY FEATURES

- Precast system was extensively adopted for the development to enhance productivity, with an average of 175 pieces of precast elements per floor. These included precast planks, precast walls, precast lift walls, precast beams, precast trellises and precast balconies.

- On-site precast yard was set up to fabricate precast planks due to their size and large quantities. The precast planks were produced based on Just-In-Time (JIT) technique that helped to improve overall installation efficiency.

- Adopted prefabricated and pre-insulated air-con ducts which were easy to handle during installation, thus improving work processes and reducing manpower usage.

- Use of self-compacting concrete for the staircase shelter walls helped to improve productivity since less manpower was needed for the casting process.

- Used Building Information Modelling (BIM) to detect and eliminate trades clashes and conflicts, thus minimising reworks which in turn saved cost and time. The adoption of Theory of Constraints (TOC) Buffer Management Model which is a project management system also helped the project team to surface out constraints and identify critical tasks for resource planning and management.

- Early collaboration between the project team and the precast specialist during pre-construction stage helped to reduce the types of curvatures for the precast trellis and balconies without compromising the original architectural intent, as well as ease the precast installation with simple and effective connections.
RESIDENTIAL HALLS AT NANYANG CRESCENT, NTU
Residential Non-Landed Buildings Category ≥ 25,000m²

CONSTRUCTION PRODUCTIVITY AWARD – PROJECTS | PLATINUM

KEY FEATURES

• The halls were made up of 676 numbers of prefabricated and prefinished steel modules with maximum dimensions of 3.25m width, 10.76m length, and 3.14m height. Each module was constructed with internal fixtures such as lighting, windows and fans at the factory before delivered to site for assembly.

• Only 7 workers were required to install a module in 30 minutes. A total of 6-8 modules were installed in a day. The duration of on-site works due to PPVC adoption was only 6 months with the floor cycle shortened to approximately 4 days as compared to conventional construction methods.

• The room modules and size of structural members were standardised with a high degree of repetition to reap the full benefits of Design for Manufacturing and Assembly (DfMA). The innovative design of the connections between the modules required only a bolt and tie plate assembly, thus eliminating welding on site.

• Façade sub-assembly was customised to project design requirements for a unique and non-monotonous façade design. Off-site assembly of the façade components in Singapore fit-out factory in a controlled environment ensured good workmanship and reduced the need for scaffolding works at height.

• Adoption of PPVC resulted in higher quality finishes, less labour intensive activities on site, better housekeeping and reduction of wastage.

Developer: Nanyang Technological University, Office of Development & Facilities Management
Architectural Consultant: SAA Architects Pte Ltd
Structural Consultant: KTP Consultants Pte Ltd
Design and Build Contractor: Santari-Zheng Keng JV
PPVC Specialist: Moderna Homes Pte Ltd
THE WAVE
Institutional Buildings Category

CONSTRUCTION PRODUCTIVITY AWARD – PROJECTS | PLATINUM

KEY FEATURES

• First building in South-East Asia to use Mass Engineered Timber (MET) on a large scale. Being lightweight, the use of MET allowed ease of handling, assembly and installation on site without the need for scaffolding. The MET components were precision cut in the factory and delivered to site ready to be assembled without any further cutting. This resulted in less waste on site.

• The completed building has a unique wave-like timber roof structure spanning 72 metres, which was constructed without using any temporary scaffold supports. This huge roof was completed in a short period of 35 days.

• The MET superstructure was designed with simple screw or bolt connections using simple hand tools such as hammer, screw driver or torque wrench. It was erected using only a team of 13 workers over a short duration of 6 months.

• Building Information Modelling (BIM) was used to design the entire building. The 3D model enabled visualisation and clash detection to be carried out, thus allowing the project team to resolve all technical problems and to firm up the integrated design before construction took place. The use of BIM also allowed the optimum quantity and sizes of the various building materials to be pre-determined. This resulted in minimal construction material wastage.

Developer
Nanyang Technological University

Architectural Consultant
Sembcorp Architects & Engineers Pte Ltd

Structural and M&E Consultant
T.Y. Lin International Pte Ltd

Conceptual Design Architect
Toyo Ito & Associates, Architects

Collaborating M&E Consultant
ME(tcs) Consulting Engineers

Design and Build Contractor
B19 Technologies Pte Ltd

MET Specialist
Struts Building Technology Pte Ltd
Blocks 75 and 77 were constructed using structural steel system. This allowed fast and safer construction with better quality control. The structural connections utilised bolts and nuts which resulted in lesser manpower needed.

Block 81 was constructed using Mass Engineered Timber (MET) comprising Cross Laminated Timber (CLT) and Glulam system. CLT was used for the floor slabs and Glulam for the columns and beams. Being lightweight, MET allowed the use of simple machines for installation which reduced the reliance on crane usage at site.

Each MET structural component used was labelled and itemised. Their locations were shown on the 3D model which was monitored on site. This has allowed for smart tracking of the materials on site. In addition, as all the timber components were prefabricated precisely, only minor adjustment works were required to be made on-site, which enhanced the overall productivity.

The use of dowel pins for the fixing of the timber members greatly reduced the time taken to fasten nuts and washers, thus improving manpower efficiency and productivity as compared to the conventional method of using sheer pins.

The use of Building Information Modelling (BIM) from early design stage allowed ease of coordination amongst the project team members as well as assembling of building components to be carefully studied in real time. This provided opportunities for the design team to optimise building costs.
The four tunnels were built using precast concrete, which was cast offsite and subsequently delivered to site for assembly at the tunnel boring machine (TBM) area. The offsite casting reduced the amount of manpower required on site and improved work productivity.

The soil pump system from Japan was pioneered in C929A. It allowed the spoil from the TBM to be transferred directly from the screw conveyor all the way to the muck pit, without the need for locomotives and gantry cranes. This resolved the working space constraint issue while eliminating the risk of locomotives hauling muck buckets in the tunnel and regular lifting of the muck buckets by the gantry crane in the launch shaft. Productivity was improved with less manpower needed.

To improve productivity and reduce risks of site activities, a TBM computer system was used to closely monitor the TBM progress. This provided a more accurate update on the progress of the work activities and the project team could monitor from the office and respond quickly to any change in the work conditions/activities.

The escape shaft wall was constructed using self-climbing formwork which eliminated the use of crane and reduced manpower needs. Casting cycle time was improved which accelerated the construction works.
KEY FEATURES

• A peanut shaped diaphragm wall was used to construct the 12m deep basement. Being strut free, there were less obstructions which allowed more working space for excavation works, thus leading to higher productivity.

• Extensive use of precast components such as beams, planks, refuse chutes, planters, bay windows, staircase flights and walls. These components were precast on-site to allow better coordination with the site progress.

• The use of pre-finished architectural pattern façade walls provided consistent texture and pattern which did not require additional rendering works and reduced the risk exposure to workers working at height.

• Prefabricated bathroom units (PBUs) were adopted to improve efficiency and quality control of a space in residential units that traditionally involved many trades. With PBUs, different trades such as waterproofing works, tiling works and fitting works were integrated more efficiently at the PBU factory before delivery and installation on site. This resulted in a neater and cleaner site.
Due to its high rise development, precast columns/walls with hollow core system was adopted to reduce the self-weight of precast columns and walls for ease of hoisting and faster installation time. The system also reduced the need for conventional formwork and external scaffold.

• Easy connection of column to column joints was designed using splice sleeve connection system.

• All the external facade and partition walls were precast to reduce the manpower required on site. Window frames were also cast-in with the external façade.

• Adoption of the precast column skin eliminated the need for workers to fabricate external formwork at the column / beam interface.

• Mechanical & Electrical (M&E) provisions and openings were integrated during the precast shop drawing development stage. Precast columns, façade and slabs came with M&E provision such as recess and opening so as to allow easier piping/conduit works with patch back grouting only.

• Converted in-situ roof screen wall of 9m high to precast for the residential blocks which helped to speed up the roof construction process and increased productivity. This was also a safer approach as the use of external cantilever working scaffold was not required.
The PPVC modules consisted of structural steel hollow section columns, floor beams and stumps as well as floor and wall bracing plates. The floor and roof were constructed using fire rated boards. The off-site production of the PPVC modules led to savings in time and manpower. The repetitive unit design also enabled the standardisation of the modules which increased efficiency and speed of construction.

Sub-assembly façade design features such as clothes drying racks, horizontal louvres screening and vertical aluminium shading devices including the air-con ledges were assembled off-site and integrated onto the main structure of the PPVC modules. This improved productivity as the entire PPVC modules complete with the architectural design features were hoisted and installed directly on site without the need for separate scaffolding to assemble the façade attachments.

The PPVC modules were connected either vertically and/or adjacent to one another using nuts and bolts. Other connections for sub-assembly components were done with mechanical fixing details. This minimised wet works on site.

Building Information Modelling (BIM) was adopted which helped in the coordination of the PPVC modules and allowed strategic planning of construction sequence and site management. The BIM model was also used to analyze the structural integrity of the building.

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WOODLANDS CARE HOME
Institutional Buildings Category

CONSTRUCTION PRODUCTIVITY AWARD – PROJECTS | GOLD

KEY FEATURES

- Adopted hybrid Prefabricated Prefinished Volumetric Construction (PPVC) that combined steel main frame carcass and reinforced concrete base slab with precast panels for subsequent clad-on as the facade.

- Typical layouts were cluster-oriented which made it relatively easy for PPVC modularisation. Overall, the PPVC modules were standardised into 4 types with consideration for the module weight and size, logistics arrangement as well as crane arrangement.

- All the column connectors were simplified, using only 4 types which eased mass fabrication and made the connections easy.

- The project achieved a 12 day cycle per floor, with each floor consisting of 54 modules and with 4 modules installed per day.

Developer
Ministry of Health

Architectural, Structural and M&E Consultant
Surbana Jurong Consultants Pte Ltd

Design and Build Contractor
Dragages (S) Pte Ltd
Key Features

- Precast columns with temporary hollow core inside the columns were adopted to overcome and manage the weight issue. These voids were filled with concrete at later stage together with floor casting. This helped to eliminate the use of scaffolding for site safety.

- Precast slabs and pre-stressed precast U-beams were adopted in lieu of conventional cast in-situ construction. This improved site productivity since formwork was not required.

- Adopted screedless floor which allowed direct tiling and granite floor installation, thus eliminating wet trades and the time needed for extra topping and levelling works.

- Due to the huge columns and high volume design for the project, heavy lifting cranes were deployed to minimise the process of crane set-up and cut short the hosting lead time.
Adopted precast slabs, precast columns with cast in-situ beams for the super structural system. Other precast components adopted included precast staircases and precast façade.

Common brackets for M&E services, pre-insulated chilled water pipes and prefabricated duct work were implemented on site to simplify the site process and save time for construction.

Building information Modelling (BIM) was used throughout the project to provide better coordination and detection of conflicts in structures and systems. Precast 4D sequencing cycle was also created using BIM model to help with easy understanding of the precast installation. In addition, 5D BIM was implemented for accurate quantity take-off to minimise wastage.