



BCA AWARDS 2024

Recognising Excellence in the Built Environment

**DESIGN AND ENGINEERING
SAFETY AWARD**



DESIGN & ENGINEERING SAFETY AWARD



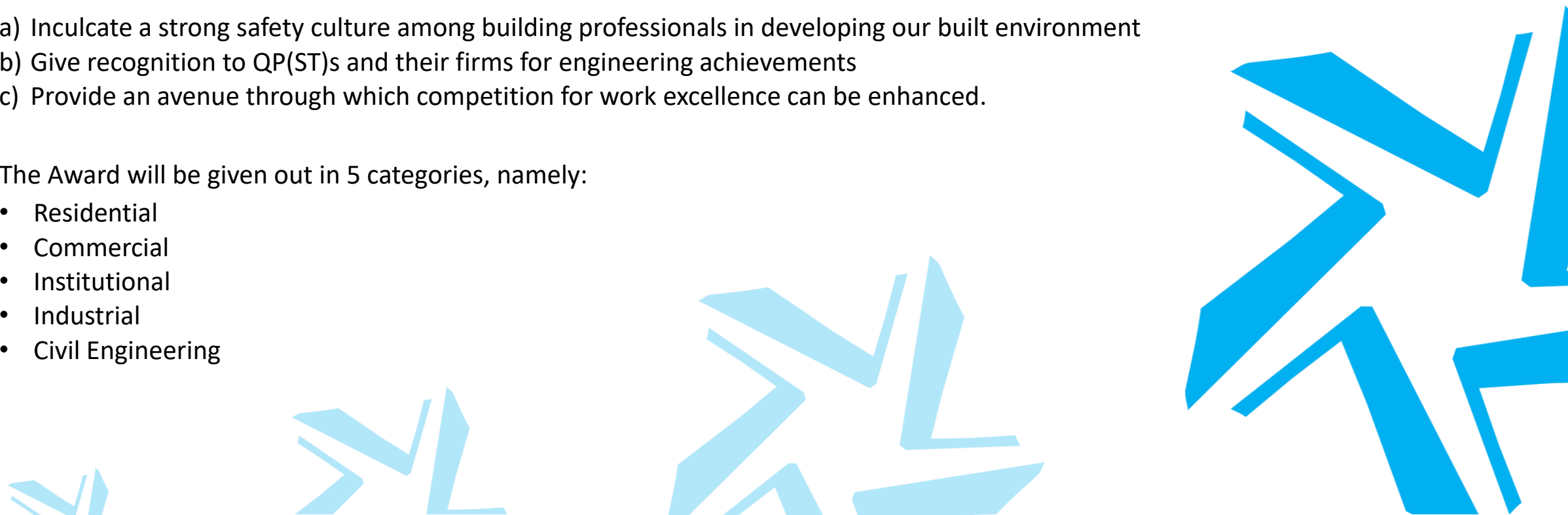
The BCA Design & Engineering Safety Award (DESA) gives recognition to the Qualified Person for Structural Works [QP(ST)], QP(ST)'s firm and the project team for ingenious design processes and solutions in overcoming project challenges to ensure safety in design, construction and maintenance of building and civil engineering projects locally and overseas.

The Award aims to:-

- a) Inculcate a strong safety culture among building professionals in developing our built environment
- b) Give recognition to QP(ST)s and their firms for engineering achievements
- c) Provide an avenue through which competition for work excellence can be enhanced.

The Award will be given out in 5 categories, namely:

- Residential
- Commercial
- Institutional
- Industrial
- Civil Engineering



Award Winners of BCA DESA 2024

Rivière

CapitaSky

Surbana Jurong Campus

BCA Braddell Campus Phase 2 Intensification Project

JTC Logistics Hub @ Gul

*Contract T219 – Construction of TEL Orchard Station
and A&A to NSL Orchard Station*

Rivière

Winner of Residential Category

BCA DESIGN AND ENGINEERING SAFETY AWARD 2024



Photo Credit to SCDA Architects & Finbarr Fallon

Qualified Person

Engineer Aaron Foong Kit Kuen

C&S Consultant

KTP Consultants Pte Ltd

Builder

Woh Hup (Private) Limited

Developer

Frasers Property Singapore

Architectural Consultant

P&T Consultants Pte Ltd

KEY CHALLENGES

- Challenging geology consisting thick layers of soft Marine Clay with unbalanced lateral earth pressure swaying towards Singapore River housing three levels of deep basements.
- Tight site with one single access point surrounded by existing buildings and the Singapore River requiring optimization of the construction productivity both on-site and off-site.
- Meticulous restoration of three units of a century old Godown heritage buildings with stringent conservation requirements to create new connectivity, improve sheltered accessibility and spatial specifications for modern commercial use.

SOLUTIONS

- Engineering-led innovation and collaborative team approach realizing the strut-free circular earth retaining structures made up of diaphragm wall panels for the basement construction enabling high productivity, robust and an overall buildable solution.
- Dual-pronged approach in combining numerical engineering modelling methods and experimental testing of the PPVC wall structures to ensure safe and optimized DfMA installation for the high-rise construction.
- Restoration transformation delivered via rigorous engineering analysis with carefully considered loading scenarios and in-depth investigative testing to ensure structural integrity of the newly integrated structures while maintaining the charm of the key historical features.

CapitaSky

Winner of Commercial Category



BCA DESIGN AND ENGINEERING SAFETY AWARD 2024



Photo Credit to CapitaLand

Qualified Person

Engineer Yiong Hoi Liong

C&S Consultant

P&T Consultants Pte Ltd

Builder

Shimizu Corporation

Owner

79RR LLP (CapitaLand)

Architectural Consultant

DCA Architects Pte Ltd

Geotechnical Specialist

Professor Harry Tan Siew Ann

Specialist Consultant

Meinhardt (Singapore) Pte Ltd

Specialist Consultant

KK Lim & Associates Pte Ltd

Concept Architect

Gensler Singapore Pte Ltd

KEY CHALLENGES

- Located at former Central Provident Fund (CPF) building, CapitaSky 185m tall, 29-storey Grade A Office Building is the **1st Commercial Redevelopment Building** in Central Business District (CBD) to **REUSE 100% of Existing Bored Piles.**
- Former CPF building was supported on 186 bored piles and a 10m thick cellular raft with two basements of 10m deep basement walls that were built along the boundary line site basement plan of 100m length by 33m width within close proximity of other adjacent high-rise buildings.
- The site is in close proximity to the existing underground railway tunnels (East-West Line) along Robinson Road and within LTA Railway protection zone (1st Reserve line).

SOLUTIONS

- Adoption of Design for Manufacturing and Assembly (DfMA) with implementation of Integrated Digital Delivery (IDD) to integrate the work processes from design, fabrication and assembly on-site, as well as the operations and maintenance of the building, Productivity improved by 45%.

DfMA

- Hybrid Structural System - Precast Perimeter Columns/ Precast Central Corewalls & Precast Perimeter Beams with Steel Structural Beams / Steel Structural Deckings.
 - 17m Long Cantilever Steel Truss System for 9m high clear ceiling at Level 2 Main Lobby.
 - Building self-weight is significantly reduced with steel structural elements which attributes lighter foundation. This is an Important Contribution factor for the REUSE of existing bored piles
- Sustainable Design – Reduce, Reuse & Recycle – REDUCTION OF EMBODIED CARDON EMISSION – 37% Reduction in Carbon Emission for 100% Reuse of Existing Piles with saving of 8400tons of Concrete for new piles.
 - REUSE of all Existing 186 Bored Piles and 42 New Bored Piles for the foundation works
 - RETAIN Existing substructures and cast a new 3m thick pile raft within existing basements which successfully minimized environmental impact and avoided excessive ground movement to safe guard surrounding buildings and the railway tunnels.

Surbana Jurong Campus

Winner of Commercial Category



BCA DESIGN AND ENGINEERING SAFETY AWARD 2024



Photo Credit to Surbana Jurong & Darren Soh

Qualified Person

Engineer Aaron Foong Kit Kuen

C&S Consultant

KTP Consultants Pte Ltd

Builder

Boustead Projects E&C Pte Ltd

Developer

Surbana Jurong

Architectural Consultant

Surbana Jurong Consultants Pte Ltd

Concept Architect

Safdie Architects

KEY CHALLENGES

- Inverted pyramid self-shading structures of the blocks with over one-third of the narrowest Eastern Block's building footprint cantilevered over the base of the building.
- Intricate engineering design solution using sophisticated linkage structures was required to enable seamless connectivity across the ten blocks and translucent spatial quality of the atrium space for the biophilic development.

SOLUTIONS

- Innovative Design for Manufacture and Assembly (DfMA) design strategies using Precast Post-tensioned Concrete Vierendeel frames in the Eastern Blocks is underpinned by rigorous engineering research via high granular modelling and scenario-based nonlinear analysis, ensuring the cantilevered building structures remain durable under the effect of concrete creep and shrinkage in long run.
- 8-storey high steel "A" frame structures feature slender vertical columns coupled, with slanted columns supported by long-span compression arch that connect all ten blocks with aerial walkways and support full-height glass facade. Meticulous buckling analysis was conducted to reconcile complex load paths and ascertain effective length of structural elements, considering the complex geometrical conditions.
- The fully cantilevered entrance canopy, up to 16 metres in length with a remarkable span-depth ratio of 40, carries the glass canopy without any support of conventional tiebacks, requiring sophisticated parametric analysis and robust structural design. This innovative engineering design of translating the vertical lever arm to a horizontal plane was inspired by the Artist's Conk fungus.
- Complex engineering integration of bridging elements, via the multi-storey hanging bridging buildings spanning 31m interwoven with the elegant demountable tensile lightweight cable structures in the atrium roof spanning 40m, enables seamless connectivity across all the blocks, contributing to a sustainable, resilient, and immersive biophilic environment.

BCA Braddell Campus Phase 2 Intensification Project

Winner of Institutional Category



BCA DESIGN AND ENGINEERING SAFETY AWARD 2024



Photo Credit Xylia Chen

Qualified Person

Engineer Chan Ewe Jin
Engineer Sharron Ng Shu Wei

C&S Consultant

ECAS Consultants Pte Ltd

Builder

Dragages Singapore Pte Ltd

Developer

Building and Construction
Authority

Architectural Consultant

ADDP Architects LLP

KEY CHALLENGES

- Implementation of 3 different types of Design for Manufacturing and Assembly technologies (DfMA) in one project within a fixed timeline.
- The adoption of Mass Engineered Timber (MET) as construction material in Singapore's wet-and-hot cyclical weather condition.
- Prop free construction installation method to be adopted. Erection and construction without the use of temporary propping and support
- The adoption of 6-sided PPVC poses constraints to the space utilization requirement in the design e.g. office space etc.

SOLUTIONS

- Integrated Project Delivery (IPD) and Virtual Design and Construction (VDC) were adopted and supported by the "Big Room" and Integrated Concurrent Engineering (ICE) concept work to achieve close collaboration and ensure the success of the project in a timely manner.
- Meticulous moisture management for the MET structure with a systematic moisture monitoring plan during construction stage to ensure moisture can be wicked off and prevention of the water standing after each rain event. Good practices were also put in place to ensure no standing water collected on the Cross Laminate Timber (CLT) or being trapped in the MET connections.
- For Prop free erection, the structural steel cores at the 7-storey block (MET) was first erected for structural stability and act as a safe working access. This was followed by zone-by-zone installation with the sequence of column-beam-CLT in each zone. For the 16-storey tower block with the adoption of Advance Precast Concrete System (APCS) and open module, the team devised a 3-dimensional APCS wall ie. precast L-shape wall.
- Open module ie. an inverted "U" system which omitted the bottom slab provides more flexibility in spatial configurations for open office space in design leading to less boxy building envelope.

JTC Logistic Hub @ Gul

Winner of Industrial Category



BCA DESIGN AND ENGINEERING SAFETY AWARD 2024



Photo Credit to Kimly Construction Pte Ltd

Qualified Person

Engineer Kam Mun Wai

C&S Consultant

Meinhardt (Singapore) Pte Ltd

Builder

Kimly Construction Pte Ltd

Developer

JTC Corporation

Architectural Consultant

AWP Pte Ltd

Structural Steel Specialist

SEN SG Pte Ltd

KEY CHALLENGES

- JTC Logistics Hub @ Gul is an integrated facility comprising a 9-storey multiple-user ramp up warehouse, an Inland Container Depot (ICD) and a heavy vehicle park, all under one roof.
- The design of both the warehouse and ICD involves long span structures ranging from 12m to 22.65m and high imposed loadings.
- The ICD is high-volume, with stringent inter-storey drift control and slender columns of up to 45m.

SOLUTIONS

- Advanced DfMA technologies with prop-free construction was adopted. Hybrid structural systems that are highly-buildable, are engineered to overcome the unique challenges and requirements of the warehouse and ICD.
- The warehouse adopts full precast concrete construction for the beams, ribbed slabs, columns and walls, stitched with in-situ concrete topping to achieve monolithic framed structure. The precast ribbed slabs and beams are acting as permanent formworks which avoid the need of temporary falsework during erection.
- Innovative steel is implemented for the ICD, pioneering the first application of the SEN System in Singapore. The system consists of two traits - Thin Steel-plate Composite (TSC) Beams and Form Prefabricated Steel Reinforced Concrete (FPSRC) Columns.
- The 45m high FPSRC columns are cast-in-situ concrete columns which are reinforced with steel lattices, prefabricated using battened structural angles. The system is ideal for productive erection and casting of the tall concrete columns in the ICD.
- The project is executed with Integrated Digital Delivery (IDD), embracing virtual design, automation and smart construction technologies. Deployment of super high performance cranes (up to 64 ton capacity), is implemented to improve site safety, buildability and precast supply resilience.

Contract T219 – Construction of TEL Orchard Station and A&A to NSL Orchard Station

Winner of Civil Engineering Category



BCA DESIGN AND ENGINEERING SAFETY AWARD 2024



Photo Credit to Finbarr Fallon

Qualified Person

Engineer Lim Soon Hui

C&S Consultant

AECOM Singapore Pte Ltd

Builder

Penta-Ocean / Bachy Soletanche
Joint Venture

Developer

Land Transport Authority

Architectural Consultant

SAA Architects Pte Ltd

KEY CHALLENGES

- To convert existing Orchard MRT station into a major interchange station with minimal disruptions to train operations and inconvenience to patrons of ION Orchard shopping mall and residents staying at 56 storey high-end ION Orchard Condominium.
- To design and construct a shortest and direct platform link between TEL and NSL below the existing Orchard station without compromising operational requirements.
- To engineer a workable and safe solution in mining sequence, underpinning at the existing Orchard Station without compromising the structural integrity.
- To construct platform link below Orchard Boulevard without temporary traffic diversion and open cut top-down or bottom-up construction.

SOLUTIONS

- Designed mining and underpinning scheme without compromising pile load transfer, existing NSL base slab deflection and track movement. Strategic placement of instruments ensured the monitored data is on par with step-by-step modelling on mining, underpinning and pile cutting without disrupting train operation.
- Designed innovative mini steel pipe pile with double flat jack installed, to ensure existing NSL base slab is supported during the mining and underpinning operation. Deployed a special tailored-made low headroom multi-task piling machine for boring into hard strata, following the lowering of rebar cage and threaded steel piles prior to casting and grouting operation.
- Adopted 1200mm diameter pipes together with retractable micro-tunnel boring machine (M-TBM) and steel frames formed an interlocked water-tight canopy roof for the mining underneath the existing Orchard Boulevard without temporary traffic diversion for the deep platform link construction.

WINNERS OF BCA DESIGN AND ENGINEERING SAFETY AWARD 2024

PROJECT NAME	PROJECT TYPE	QP / QP COMPANY
Rivière	Residential	Engineer Aaron Foong Kit Kuen KTP Consultants Pte Ltd
CapitaSky	Commercial	Engineer Yiong Hoi Liong P&T Consultants Pte Ltd
Surbana Jurong Campus	Commercial	Engineer Aaron Foong Kit Kuen KTP Consultants Pte Ltd
BCA Braddell Campus Phase 2 Intensification Project	Institutional	Engineer Chan Ewe Jin & Engineer Sharron Ng Shu Wei ECAS Consultants Pte Ltd
JTC Logistics Hub @ Gul	Industrial	Engineer Kam Mun Wai Meinhardt (Singapore) Pte Ltd
Contract T219 – Construction of TEL Orchard Station and A&A to NSL Orchard Station	Civil Engineering	Engineer Lim Soon Hui AECOM Singapore Pte Ltd

Organiser



An Initiative Under

