



BCA AWARDS 2017

Recognising Excellence in the Built Environment

Building and Construction  Authority

We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.

BCA Design and Engineering Safety Excellence Award

The BCA Design and Engineering Safety Excellence Award 2017 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 Awards will be given out for the following categories:

- Residential
- Commercial
- Institutional and Industrial
- Civil Engineering
- Small Scale Projects (Project cost \leq \$30 million) ***NEW***
- Overseas

The Scotts Tower

Residential Category

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

AWARD

**Qualified Person**

Engineer Aaron Foong Kit Kuen

C&S Consultant

KTP Consultants Pte Ltd

Builder

Daewoo Engineering &
Construction Co. Ltd

Developer

Far East Organization

Architectural Consultant

ONG&ONG Pte Ltd

KEY CHALLENGES

- The construction of the two levels of basement within the 10m depth of soft soil layer situated on the LTA MRT protection zone.
- The iconic high rise tower has a challenging geometry demanding a column-free volume spanning a maximum of 33m at Level 2 sky lobby periphery which truncates the vertical supports from all the thirty (30) floors of superstructure floors above it.
- The tower carries highly concentrated loads from inclined mega columns and central spine corewalls that are to be supported by a second generation foundation within a limited footprint shared with the abandoned foundation from the former Cairnhill Towers.

SOLUTIONS

- Dual-Ring earth retaining wall with a single layer of temporary steel strutting was designed to allow the tower construction to progress concurrently with the podium basement excavation with minimal obstruction for the soft marine clay removal and safeguarding the MRT tunnels along Scotts Road.
- A robust "outrigger" transfer system mobilising the high stiffness central corewalls spine with a pair of splayed balanced cantilever fin beams with secondary tie beams on four (4) inclined mega columns for optimised structural efficiency with high redundancy in load paths.

H₂O Residences

Residential Category

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

MERIT

**Qualified Person**

Engineer Lauw Su Wee

C&S Consultant

LSW Consulting Engineers
Pte Ltd

Builder

Woh Hup (Private) Limited

Developer

Impac Holdings Pte Ltd

Architectural Consultant

DP Architects Pte Ltd

KEY CHALLENGES

- The excavation works for the basement construction was a challenge as there are inherent poor soil conditions where soft soil layers were founded to be approximately 15m thick from ground level. The excavation depth for two basements was 7m and the project locality is beside Layar LRT Station, as such the challenge is to construct the basement without affecting Layar LRT Station and the rail structures.

SOLUTIONS

- Complex ERSS incorporates ground improvement with Deep cement mixing method to stabilise the base and secant piles wall as temporary wall during construction and permanent wall upon completion of basement walls.
- Transfer Beams with upstand walls to function as a services corridor to be prevent any honeycombing or reinforcement congestions within the Transfer Beam which are a critical structures.
- The use of Precast Structures such as PBUs and toilet slabs allow for works being able to be done in parallel brings about savings of construction time.

SBF Center

Commercial Category

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

AWARD



Qualified Person

Engineer Allan Teo Kok Jin

C&S Consultant

KTP Consultants Pte Ltd

Builder

Woh Hup (Private) Limited

Developer

Far East Organization and

Far East Orchard Limited

Architectural Consultant

DP Architects Pte Ltd

KEY CHALLENGES

- The development is located within the First Reserved Line of East-West Line MRT tunnel and in close proximity with adjoining structures of various services and buildings and is one of the many slender buildings in Singapore CBD area with tower height of 184m, floor plan width of only 20.2m and a slenderness ratio of 9.1.
- Differences between office (tower) and medical suite (podium) layout and column setting out plans due to different floor usage requirements.
- Pile raft foundation supporting the 31-storey office tower requires casting of thick RC foundation which may create large cross-sectional temperature differential due to heat of hydration.

SOLUTIONS

- Top-down construction with secant bored pile wall system were adopted as the earth retaining and stabilising structure (ERSS) to minimise impacts and hazards to the neighbouring structures. Secant bored pile wall provides water tightness while constructed RC slab possess greater stiffness as struts to the retaining secant bored pile wall.
- Transfer floor with long span transfer beams system was introduced at the intersection between office and medical suite floors to transfer loadings from different setting out of column positions.
- Main lateral load resistance system of the structure is provided by the tower lift core and gable end walls. The overturning moment acting on the building is resisted by a "push and pull" coupling effects generated by compression and decompression in the walls which minimizes building sway and reduces accelerations under wind loads to acceptable levels for occupant comfort.
- Adiabatic Temperature Rise (ATR) test was carried out prior to actual casting of the thick RC foundation to forecast the cross-sectional temperature differential. Data obtained from the tests are then used to carry out studies in minimizing the risk of thermal cracking during construction.

Galaxis

Commercial Category

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

MERIT

**Qualified Person**

Engineer Foo See Lim

C&S Consultant

Meinhardt Infrastructure
Pte Ltd

Builder

Singapore Engineering &
Construction Pte Ltd

Developer

Ascendas Fusion 5 Pte Ltd

Architectural Consultant

Aedas Pte Ltd

KEY CHALLENGES

- Construction was within LTA's railway protection zone. One of the office blocks is supported on MRT station structure and there is connection to the station concourse by a pair of escalators through the deep basement wall.
- Design aimed to achieve seamless connectivity to surrounding buildings via underground linkways and elevated bridges. There was no disruption to commuters and business operations during construction.
- Unique building profiles of slanting and curving edges are integrated with long span structural system.

SOLUTIONS

- Rigorous analysis and checking on interface requirements were performed to ensure no intolerable impact to adjacent structures.
- Physical connection to MRT station was done after the external hull completion under a fully-secured environment.
- Structural system was developed in conjunction with Contractor's core business and expertise so as to deliver safe and quality works.
- Careful curtailment of structures was carried out to overcome temporary construction loads and permanent lateral sway caused by asymmetrical building layout.

NUS AS8

Institutional & Industrial Category



BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

AWARD



Qualified Person

Engineer Aaron Foong Kit Kuen

C&S Consultant

KTP Consultants Pte Ltd

Builder

Ken-Pal (S) Pte Ltd

Developer

National University of Singapore

Architectural Consultant

Architects 61 Pte Ltd

KEY CHALLENGES

- Building setting out being wrapped within an unbalanced slope height of 16.5m with left in underground obstructions from the former admin block.
- Permanent lateral earth loads to this highly permeable building posed challenge to load path continuity.
- The undulating variation of soil geology across the site from weak residual consolidating soil to weathered hard siltstone poses potential long term differential settlement on the building.

SOLUTIONS

- Adoption of earth retaining and stabilizing structures (ERSS) consisting of Contiguous Bored Pile (CBP) restrained by three (3) layers of removable ground anchor (GA) to achieve a strutless excavation depth of 16.5m in a safe manner.
- Rigorous design and robust detailing of a highly buildable structural frame to resist the locked-in lateral earth loads from the slope while achieving the architectural intent of discontinuity in space volumes.
- A hybrid of piling and ground bearing raft foundation was adopted with double prong solution in eliminating the constraints of existing left-in underground pile obstruction to free up the flexibility of new superstructure column placement and addressing the potential excessive structure settlement due to weak pockets of consolidating soil.

Singapore Management University School of Law

Institutional & Industrial Category



BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

AWARD



Qualified Person

Engineer Kam Mun Wai

C&S Consultant

Meinhardt (Singapore) Pte Ltd

Builder

Kajima Overseas Asia Pte Ltd

Developer

Singapore Management University

Architectural Consultant

MKPL Architects Pte Ltd

KEY CHALLENGES

- Deep excavation carried out in undulating site terrain, resulting in unbalanced excavation work and forces, in close proximity to Conservation Shophouses, Fort Canning Tunnel, Peranakan Museum (National Monument) and heritage trees.
- Highly variable ground conditions with Fort Canning Boulder Bed with buried box drain across middle of the site requiring permanent drainage diversion.
- Restricted building AMSL with very tight floor-to-floor height constraint.
- Design requirement for long-span column-free function hall at Basement 1 with seminar rooms and teaching facilities above.
- Iconic law library dome, and cantilevered box structure overseeing Armenian Street.

SOLUTIONS

- Robust earth retaining/stabilising structure (ERSS) adopting cost effective contiguous bored pile wall and semi-top down construction. The ERSS design, coupled with a well-planned sequence and methodology, enabled substructure excavation and construction independently over 3 zones across the site. Real time automatic monitoring of movement in Fort Canning Tunnel to enhance safety and productivity.
- Innovative and cost efficient vertical stacking of primary and secondary warren trusses with composite steel floor decking from 2nd storey to Roof to provide column free double volume space over B1 function hall. The warren trusses span 33.6m across the function hall. The trusses are fully coordinated and integrated with the architectural expression, school programming, as well as incorporating MEP services within the tight ceiling space. The warren trusses and composite steel framing were prefabricated off site, assembled and lifted into position on site.
- Highly-buildable and efficient structural systems for other areas, to complement iconic architectural expressions.

Grace Assembly of God Church

Institutional & Industrial Category

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

MERIT



Qualified Person

Engineer Lauw Su Wee

C&S Consultant

LSW Consulting Engineers
Pte Ltd

Builder

Gammon Pte. Limited

Developer

Grace Assembly of God

Architectural Consultant

LAUD Architects Pte. Ltd

KEY CHALLENGES

- Deep excavation in closely built up area with irregular basement layout and difficult ground condition.
- Various "column free" service halls and car park at 1st, 2nd and 3rd storey; requiring long span structure solutions.
- Multi-story transfer due to different floor layouts.

SOLUTIONS

- "strut free" semi-top down excavation with SBP wall as retaining wall and perimeter of the basement slab as horizontal support; the 3-basement excavation was completed in 4 months.
- 2-Way PT waffles slabs with only 750mm depth for maximum floor plate the size of 34m x 38m with minimum column/wall supports at the perimeter.
- 38m span composite trusses to allow for a "column" free service hall; the total 9 numbers of composite trusses were fabricated off site, while on site assembling and erection only took 3 days.

Intra-Island Cableway at Sentosa Island

Civil Engineering Category

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

MERIT

**Qualified Person**

Engineer Lai Huen Poh

C&S Consultant

RSP Architects Planners &
Engineers (Pte) Ltd

Builder

Gammon Pte. Limited

Developer

Sentosa Development
Corporation

Architectural Consultant

RSP Architects Planners &
Engineers (Pte) Ltd

KEY CHALLENGES

- Laying-out and siting of the 3 cableway stations and 8 cableway towers within an established forested environment with considerations for site access, construction and future operational requirements.
- To resolve the cableway loads in various load combinations with efficiency of transferring these loads with coherent engineering and innovative and efficient use of intrinsic structural materials to achieve the building geometry with the required robustness, durability and sustainability.

SOLUTIONS

- The building structure of Stations and Towers were planned to respond to site topographies to optimise cut and fill thus minimising soil disposal. Efficient use of CBP walls, adopted as retaining structures to reduce cutting into the existing lush terrain and hill slope, minimally destruction and disturbance of the natural forest habitat. A balanced and innovative use and adoption of Reinforced Concrete with structural steel to achieve mass and robustness and integrating this to achieve the space and geometry unique to this building typology.
- The outcome is the maximum preservation of an established natural habitat and the integration of cableway structural elements within the elegant form envisioned by Architect and embraced by all stakeholders. An outcome safely and economically executed and implemented.

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

AWARD

Project Name	Category	QP / QP Company
The Scotts Tower	Residential	Engineer Aaron Foong Kit Kuen KTP Consultants Pte Ltd
SBF Center	Commercial	Engineer Allan Teo Kok Jin KTP Consultants Pte Ltd
NUS AS8	Institutional & Industrial	Engineer Aaron Foong Kit Kuen KTP Consultants Pte Ltd
Singapore Management University School of Law	Institutional & Industrial	Engineer Kam Mun Wai Meinhardt (Singapore) Pte Ltd

BCA DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

MERIT

Project Name	Category	QP / QP Company
H ₂ O Residences	Residential	Engineer Lauw Su Wee LSW Consulting Engineers Pte Ltd
Galaxis	Commercial	Engineer Foo See Lim Meinhardt Infrastructure Pte Ltd
Grace Assembly of God Church	Institutional & Industrial	Engineer Lauw Su Wee LSW Consulting Engineers Pte Ltd
Intra-Island Cableway at Sentosa Island	Civil Engineering	Engineer Lai Huen Poh RSP Architects Planners & Engineers (Pte) Ltd