


Design and Engineering Safety Excellence Award



The Award

The BCA Design and Engineering Safety Excellence Award aims to give recognition to the efforts taken by the qualified person for structural works, his firm and the project team for ingenious design processes and solutions in overcoming project challenges and ensuring safety in the design, construction and maintenance of building and civil engineering projects locally and overseas.

Award Categories

- a. Residential
- b. Commercial
- c. Institutional & Industrial
- d. Civil Engineering
- e. Overseas Projects

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Housing & Development Board

Design and Engineering Safety Excellence Award

78 Shenton Way
(Commercial)

★ Award



Qualified Person

Er Liew Keng How, Kenneth

C&S Consultant

T.Y. Lin International Pte Ltd

Builder

Shimizu Corporation

Developer

Singapore Shenton Holdings
Pte Ltd

Architectural Consultant

Forum Architects Pte Ltd

Construction Cost

\$65 million

Challenges:

- Constructing the new office building over the existing carpark with minimal disruption to its operations.
- Allowing for a column-free office space (22m span).
- Dealing with difficult site constraints – close proximity to other buildings and major roads, restricted access to construction site, and limited headroom and workspace in the basement.

Solutions and Features:

- Designing the new building to “straddle” over the existing carpark using steel post tensioned transfer trusses to support the weight of the additional seven storeys above it. The steel transfer trusses were erected in four segments of 65 tons each. A careful study was carried out on the mobile crane’s swinging radius in relation to site constraints, the design on a temporary erection tower, and in close liaison with the Authority for road closure to ensure safety during the erection.
- Using composite steel construction for columns located along the perimeter of the existing carpark and floor beams spanning 22m. The use of composite steel increases the material strength, reduces weight of the structure and helps to simplify the construction on site.
- Using micro-piling system to address the height and space constraints within the existing basement, with the weight of the structure reduced.
- Using off-site fabrication for structural elements minimised traffic congestion on site (which is within the busy Central Business District).

Design and Engineering Safety Excellence Award

313@Somerset
(Commercial)

★ Award



Qualified Person

Er Wong Pui Fun, Joanne

C&S Consultant

Meinhardt Infrastructure Pte Ltd

Builder

Bovis Lend Lease Pte Ltd

Developer

Lend Lease Retail
Investment 1 Pte. Ltd

Architectural Consultant

Aedas Pte Ltd

Construction Cost

\$220 million

Challenges:

- Diverting the 10-metre wide fully functional Stamford Canal at Somerset and reconstructing the permanent canal to pass through the new shopping centre.
- Minimising ground movement throughout the construction due to the site's close proximity to the MRT station and tunnel.
- Demolishing and re-constructing the MRT station entrance, while ensuring the safety of the MRT commuters (50,000 commuters daily) and pedestrians.
- Overcoming difficult ground conditions as the site is sitting on a thick layer of soft soil.

Solutions and Features:

- Integrating the Stamford Canal into the basement of the building. The canal was diverted from its course into the building via the construction of a sheet-pile wall. It was then "encased" in a new canal box section, which sits on the building's basement slab / beam.
- Minimising ground movement using diaphragm wall (continuous reinforced concrete wall), T-panel and cross diaphragm walls.
- Constructing temporary sheltered walkways for commuters and pedestrians, which required numerous diversions due to the heavy human traffic and site constraints.
- Using the Building Information Modelling (BIM) – an IT software that allows the project team to visualise building drawings and plans in 3D and perform various functions (for example, engineering analysis) – for the safe demolition of the existing MRT entrance.
- Performing a finite element analysis to gauge probable tunnel movement, and adjacent building settlement for the design of the building's diaphragm wall, due to the difficult soil conditions on site.

Design and Engineering Safety Excellence Award

City Square Residences (Residential)

★ Award



Qualified Person
Er Yeo Choon Chong

C&S Consultant
Meinhardt (Singapore) Pte Ltd

Builder
Woh Hup (Pte) Ltd

Developer
City Developments Limited

Architectural Consultant
Ong&Ong Pte Ltd

Construction Cost
\$188.7 million

Challenges:

- Managing the excavation works in three levels of basement in the presence of difficult sub-soil conditions (the site sits on a 20m thick layer of soft marine clay), and an operating water main along the sides of the site, and old shop houses in its vicinity.
- Building condominium apartments with eco-friendly features.
- Using pre-cast construction including pre-finished / fitted prefabricated bathroom units to fulfill the construction-friendly requirement of the project.

Solutions and Features:

- Building a strut-free (126m diameter) circular diaphragm wall retention system with capping beams, which facilitated easy, safe and fast excavation and construction of the basement structure.
- Using pre-cast elements extensively to reduce wastage of material and manpower on site, to increase productivity and provide a cleaner and safer working environment for the workers. A total of 77% of the bathrooms were prefabricated bathroom units using reinforced concrete design support system.

Design and Engineering Safety Excellence Award

71 Robinson Road (Commercial)

★ Merit



Qualified Person

Er Lai Huen Poh

C&S Consultant

RSP Architects Planners & Engineers (Pte) Ltd

Builder

Kajima Overseas Asia Pte Ltd

Developer

Kajima-Lehman (Robinson) Development Pte. Ltd

Architectural Consultant

Architects 61 Pte Ltd

Construction Cost

\$95 million

Challenges:

- Proximity of existing pair of East and West underground MRT tunnels lying 3m away and 10m to 14m below Robinson Road. The development footprint falls within the LTA Railway Protection Zone with part of the development encroached into Rail 1st Reserve.
- Difficult soil condition at the site with the presence of weak top soil fill and soft marine clay layers which are very susceptible to movement, vibration and groundwater drawdown.
- The existing 7-storey concrete building, which was built in 1952, required controlled demolition to bring down the structures for re-development. The challenge was how best to locate new piles to avoid existing piles or obstruction below ground.
- Site bounded by busy roads with heavy human, vehicular traffic and restricted access to construction site.

Solutions and Features:

- Removed the need for a basement to eliminate problems of water drawdown and in turn averted excessive settlement of surrounding roads, buildings and MRT tunnel structure deformation.
- Continuous real time Automated Tunnel Monitoring System (ATMS) was carried out to closely monitor the movement of the adjacent MRT tunnels.
- Existing old building basement was retained to operate as temporary earth retaining structures for piling and sub-structure works.
- The use of precast walls, parapets, and prefabricated unitised curtain walls eliminated the need for external perimeter scaffolds to ensure a safe construction environment.

Design and Engineering Safety Excellence Award

Jurong Point 2 / The Centris (Commercial)

★ Merit



Qualified Person

Er Yeo Choon Chong

C&S Consultants

Meinhardt Infrastructure Pte Ltd

Builder

Woh Hup (Pte) Ltd

Developer

Prime Point Realty
Development Pte Ltd

Architectural Consultant

cgnArchitects Pte Ltd

Construction Cost

\$250 million

Challenges:

- A major development with a tight contract schedule, where all the structural works must be completed to allow the shopping mall to be operational within 24 months.
- The need to mitigate any risk arising from the construction work, particularly the excavation for the basement, to the existing structures, i.e., Boon Lay MRT Station and Jurong Point Shopping Centre, which are in close proximity to the development.
- The need for large span structures at the bus interchange posed challenges in the design of the superstructure directly above the interchange.

Solutions and Features:

- Optimising the building layout such that the apartment towers are located away from the bus interchange footprint, thus avoiding the need for large span transfer structure.
- Devising a robust temporary earth retaining system for the basement construction. The use of secant pile wall with ground anchors eliminated the need for conventional struts and freed up working space, improved the safety of work in an excavated site and allowed for rapid construction.
- Adopting system formworks and precast units extensively throughout the project. The use of appropriate structural floor systems e.g., flat slab, hybrid semi-precast and in-situ slabs, post-tensioning at various areas allowed for a safer, more rapid and economical construction.

Design and Engineering Safety Excellence Award

City Square Mall (Commercial)

★ Merit



Qualified Person

Er Yeo Choon Chong

C&S Consultant

Meinhardt (Singapore) Pte Ltd

Builder

Kajima Overseas Asia Pte Ltd

Developer

City Developments Limited

Architectural Consultant

Ong&Ong Pte Ltd

Construction Cost

\$188.5 million

Challenges:

- Development of a 9-storey mall with four levels of basement using a safe, highly buildable and robust structural system.
- Difficult sub-soil condition with (25m) thick layers of soft soil (Kallang Formation) and site constraints such as the presence of an MRT entrance tunnel, a water main (800mm diameter), old shop houses, busy roads and on-going construction of City Square Residences adjacent to the site.

Solutions and Features:

- Adoption of Top-Down construction method, using diaphragm walls with precast concrete king posts, minimised the disturbances to the adjacent properties and resulted in earlier completion of the project by about two months. This method also resulted in significant costs and labour savings as it eliminated the need for timber formwork and steel posts.
- Use of both reinforced and post tensioned concrete flat slab systems to allow a highly buildable construction for the basement and upper floors of the mall.

Design and Engineering Safety Excellence Award

Changi Terminal 3 (Institutional & Industrial)

★ Merit



Qualified Person

Er Kueh Lip Kuang

C&S Consultant

CPG Consultants Pte Ltd

Builder

Shimizu Corporation

Developer

Changi Airport Group
(Singapore) Pte. Ltd.

Architectural Consultant

CPG Consultants Pte Ltd

Construction Cost

\$1,200 million

Challenges:

- Construction of three levels of basement had to be integrated well with the Changi Airport MRT station and involved extensive excavation work with over 1.5 million m³ of materials to be removed from the site.
- Development had to achieve a safe, efficient, buildable, robust structural system that integrates well with the overall design.
- The need for column-free spaces for the Departure Hall to integrate well with the architectural and roof design.

Solutions and Features:

- As part of the basement is directly above the MRT tunnel, a system of transfer beams on barrette piles straddling the tunnels were provided to support the terminal columns and floors above the Basement 2 level.
- Highly mechanised and buildable methods were adopted in the project. Precast double 'T' slabs were used for the floor system while an integrated and composite steel structure was adopted for the roof system.
- Large span (60m) roof trusses were designed to cover the Departure Hall. An innovative system of assembling and erecting the main and secondary trusses was adopted to enhance safety and speed of construction. Main trusses were assembled in pairs on the ground and then lifted into position using hydraulic jacks on temporary towers. A mechanised moving platform supported by the trusses was used to facilitate installation of roof services and ceiling. These solutions had greatly reduced the risk of working at height and ensured quality of work during assembly.

Design and Engineering Safety Excellence Award

Fusionopolis@one-north
(Institutional & Industrial)

★ Merit



Qualified Person

QP (D): Er Chan Yek Seng
QP (S): Er Pueh Jye Huey

C&S Consultant

Jurong Consultants Pte Ltd

Builder

Shimizu Corporation

Developer

JTC Corporation

Architectural Consultant

Jurong Consultants Pte Ltd

Construction Cost

\$300 million

Challenges:

- Architectural requirement for a columnless ground floor required the need for a transfer system to carry all loads for the floors above.
- The need for a 15m high and unrestrained single supporting column for suspended spherical theatre.

Solutions and Features:

- Adopted long span cantilevered transfer megatrusses at intermediate floors to transfer the loads to the central core walls. Post-tensioned steel-concrete composite sections were used for the tension top chord members of the trusses to eliminate tension forces. Therefore, smaller chord members were used.
- Use of linkbridges to brace spherical theatre to render the single supporting column a braced structure, and ensure compatibility between global and local models in the process.
- Installation of four cables on top of spherical theatre as redundancies in the unlikely event of a weakening of the single-supporting column.

Design and Engineering Safety Excellence Award

Singapore Flyer (Civil Engineering)

★ Merit



Qualified Person

Er Ho Chong Leong

C&S Consultant

Arup Singapore Pte Ltd

Builder

Takenaka Corporation
(Building Works) Mitsubishi
Heavy Industries, Ltd. (Giant
Observation Wheel)

Developer

Singapore Flyer Pte
Ltd + Melchers Project
Management Pte Ltd

Architectural Consultant

Kisho Kurokawa Architect &
Associates, in association
with DP Architects Pte Ltd

Construction Cost

\$200 million

Challenges:

- Development of a 165m-tall moving structure that is aesthetically elegant yet structurally stable to withstand the sudden high gusts of winds so that passengers in the capsules are comfortable during the 35-minute ride.
- Construction work has to be carried out within the tight site area. Horizontal lifting method could not be used for the erection of the structure due to the presence of terminal building and support legs.

Solutions and Features:

- Revolutionary new rim design and cable arrangement improves stability, with lower levels of prestress required in the cables.
- Balancing of forces in support structure through the ground structure of the terminal building to reduce reliance on ground to resist lateral forces.
- Extensive dynamic analyses were performed to design the structure for high wind conditions.
- Development of new vertical 'pie-slice' erection method to overcome site constraints and to reduce the risk of working at height.

Design and Engineering Safety Excellence Award

Marina Barrage (Civil Engineering)

★ Merit



Qualified Person

Er Ho Siew Koon

C&S Consultant

Camp Dresser and Mckee.
International (S) Pte Ltd /
SKM Consulting (S) Pte Ltd

Builder

Koh Brothers Building & Civil
Engineering Contractor (Pte.) Ltd.

Alternative Design Consultant

Black & Veatch (SEA) Pte Ltd

Temporary Work Designer

AGS Consultants Pte Ltd

Developer

Public Utilities Board

Architectural Consultant

Architects Team 3 Pte

Construction Cost

\$250 million

Challenges:

- Difficulties posed in the construction of the barrage structures across the Marina Channel and on reclaimed land overlain with 40m thick layer of soft marine clay.
- The need to maintain sufficient flow/opening of the channel to avoid flooding upstream during the entire construction period and for vessels to navigate in the channel.
- The need for safe maintenance of the barrage structure including the Crest Gates and Drainage Pump and protection of structure from drifting vessels during operation.

Solutions and Features:

- Non-strutted Double Walled Marine Cofferdam was designed to cater for construction of the Barrage structures across the Marina Channel in the dry condition. The cofferdam was designed to resist high water pressure (11m high) and wave height (1.5m).
- The construction of barrage was planned and carried out in two phases maintaining the opening requirement of the Marina Channel to avoid flooding upstream in the event of storms.
- Stop logs were designed to provide safe access and maintenance of the Crest Gates and Drainage Pumps in dry environment. Vessel impact barriers were designed to protect the barrage structure from drifting vessels.

Design and Engineering Safety Excellence Award

Sengkang N2C36 (Residential)

★ Merit



Qualified Person

Er Ng Peng Yuen, John

C&S Consultant

Surbana International
Consultants Pte Ltd

Builder

Kay Lim Construction and
Trading Pte Ltd

Developer

Housing & Development Board

Architectural Consultant

Surbana International
Consultants Pte Ltd

Construction Cost

\$56.8 million

Challenges:

- The development involving one level of basement car park is in close proximity to Buangkok MRT station and tunnel.
- Sengkang N2C36 was designed and planned as one of five integrated contracts with residential, commercial and communal facilities comprehensive development.

Solutions and Features:

- The basement car park and 15-storey residential building blocks were designed to be located away from the MRT station to avoid any damages to the MRT station and its facilities during construction.
- Pilecaps were integrated with flat slab system and perimeter tie beams integrated with basement walls to reduce depth of excavation which resulted in a safer and faster basement construction.
- An integrated team of consultants within Surbana allowed for close synergy in design and management of the five contracts resulting in connectivity and barrier-free built environment as well as a seamless interfacing work between contracts.
- Prefabrication with repeatable blocks, unit types and precast components simplified the design process and increased productivity, buildability and quality finishes. Materials usage and site labour were minimised resulting in a cleaner and safer working environment.

Design and Engineering Safety Excellence Award

BIDV Tower, Hanoi, Vietnam (Overseas Projects)

★ Merit



Qualified Person

Er Leung Wai Man

C&S Consultant

P&T Consultants Pte Ltd

Builder

Hanshin Engineering &
Construction Co., Ltd

Developer

BIDV Tower Joint Venture
Company

Architectural Consultant

P&T Consultants Pte Ltd

Construction Cost

US\$38 million

Challenges:

- The 25-storey office building development involved the construction of two levels of basement on thick layer of soft clay and in close proximity to Red River dyke structure and tree conservation area.
- Building has to be designed to withstand seismic load as well as high wind load (Design Wind Speed 40m/s) prescribed by local Vietnam Code.
- Building design has to comply with various international standards in addition to the requirements specified in the local Vietnamese Standard.

Solutions and Features:

- The adoption of 800mm thick diaphragm walls and barratte piles as both temporary earth retaining structures and permanent basement walls allowed safe execution of excavation work for the basement construction.
- Rigid structure of shear walls and frame system with cross-bracing at mid building height was adopted to resist the lateral forces due to wind and seismic loads.
- British Standard (BS) was adopted for reinforced concrete design of the building while the American's Uniform Building Code was used for seismic loading and Vietnam Code for Wind Loading. Careful review was needed on the adoption of the requirements under the various codes to achieve safe and economical design.