# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## The Award

The BCA Design and Engineering Safety Excellence Award is introduced this year. The aim is to give recognition to project parties, in particular professional engineers, for their efforts in devising ingenious design processes and solutions in overcoming project challenges to ensure safety in the design and construction of buildings.

## AWARD CATEGORIES

- Building Category
- Civil Engineering Category

## ASSESSMENT COMMITTEE

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| | |
|---|---|
| Mr Pek Lian Guan | BCA Board Member<br>Director, Tiong Seng Contractors (Pte) Ltd |

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| Assoc Prof Harry Tan Siew Ann | National University of Singapore |
| Er Lai Huen Poh | RSP Architects Planners & Engineers Pte Ltd |
| Er Lim Chong Sit | Association of Consulting Engineers Singapore |
| Er Dr Nasim Shahzad | Meinhardt Singapore Pte Ltd |
| Ms Rita Soh | Singapore Institute of Architects |
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| Er Yap Tiem Yew | Housing and Development Board |
| Er Ong See Ho | Building and Construction Authority |

# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## Building Category

## CHANGI AIRPORT TERMINAL 2 UPGRADING (AWARD)

| | |
|---|---|
| Qualified Person | Er Lai Huen Poh |
| C & S Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Builder | Takenaka Corporation |
| Developer | Civil Aviation Authority of Singapore |
| Architectural Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Construction Cost | $185 million |

### Challenge:

- Overcoming site constraints, such as limited working space, restricted working hours and the need to meet stringent environmental requirements

### Solutions and Features:

- Creative use of steel structures fabricated elsewhere for erection at the site ensured safe and swift construction with minimal interference with day-to-day activities at the terminal
- In many areas, the combined use of movable working platforms with cranes kept the construction away from airport users
- For existing structures that need to be strengthened, QP adopted methods that created less noise, dust and debris, such as carbon fibre-wrapping and post-tensioned cables and bracings

# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## Building Category

## ONE RAFFLES QUAY (MERIT)

| | |
|---|---|
| Qualified Person | Er Dr Nasim Shahzad |
| C & S Consultant | Meinhardt (Singapore) Pte Ltd |
| Builder | Obayashi Corporation |
| Developer | One Raffles Quay Pte Ltd |
| Architectural Consultant | Architects 61 Pte Ltd |
| Construction Cost | $420 million |

### Challenge:

- Overcoming engineering constraints posed by the presence of existing twin MRT tunnels running below the northern part of the site. These are directly below the 50-storey North Tower

### Solutions and Features:

- Transfer of interior tower loads is achieved through the central box core acting as a transfer structure. At the perimeter of the tower, loads are transferred through visible and iconic mega steel trusses
- For safe and efficient transmission of building loads to either side of the MRT tunnels, the North Tower was skewed to achieve the shortest structural transfer span and a balanced load distribution across the tunnels
- Implementation of comprehensive real-time instrumentation regime for monitoring of ground movement and tower movements to ensure safety during construction and excavation

# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## Building Category

## CENTRAL (MERIT)

| | |
|---|---|
| Qualified Person | Er Soh Seng Siong |
| C & S Consultant | KTP Consultants Pte Ltd |
| Builder | Hexacon Construction Pte Ltd |
| Developer | Far East Organisation |
| Architectural Consultant | DP Architects Pte Ltd |
| Construction Cost | $160 million |

### Challenge:

- Central is a landmark commercial development built over Clarke Quay MRT Station and is bound by the Singapore River on one side. It has a deep basement and a 16m deep link connection to the station. The main challenge is to ensure that there was no disruption to train operations

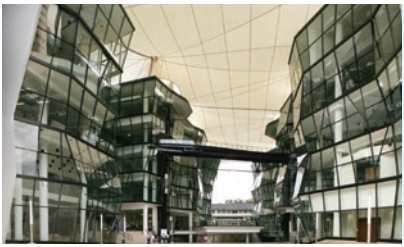
### Solutions and Features:

- Use of two levels of reinforced concrete ring beams strutting against the wall to minimise lateral movements of the basement diaphragm retaining wall
- Use of precast U-shape beams with hollow core slabs over entrances of MRT station and over the road in order to minimise traffic disruption
- To ensure that the movement of basement walls stay within the predicted estimate, extensive ground instrumentation and automatic real time tunnel instrumentation were implemented

# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## Building Category

## LASALLE COLLEGE OF THE ARTS (MERIT)



| | |
|---|---|
| Qualified Person | Er Lai Huen Poh |
| C & S Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Builder | Takenaka Corporation |
| Developer | Lasalle Foundation Limited |
| Architectural Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Construction Cost | $79.03 million |

### Challenge:

- Lasalle College of the Arts building is situated in the Rochor area where there are existing old buildings. The building complex has two levels of basement and sits on an area where there is a presence of thick marine clay

### Solutions and Features:

- To ensure minimal impact to surrounding properties, contiguous bored piles basement wall with two levels of reinforced concrete compression rings strut system was adopted
- The grout mix piles method was introduced to the underlying soft marine clay soil to create a stiff base strut layer to reduce lateral deflection of the basement wall
- To overcome the challenges posed by the unique faceted glass façade, the team looked into the method of installation and put up a full scale mock-up

# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## Building Category

## ITE COLLEGE EAST (MERIT)

| | |
|---|---|
| Qualified Person | Er Lai Huen Poh |
| C & S Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Builder | Takenaka Corporation |
| Developer | Institute of Technical Education |
| Architectural Consultant | RSP Architects Planners & Engineers (Pte) Ltd |
| Construction Cost | $185 million |

### Challenge:

- The main challenge of this large-scale project is to complete it within the stipulated 20-month time frame

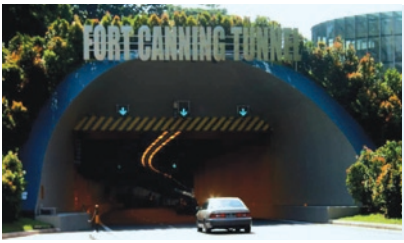
### Solutions and Features:

- A precast approach was adopted to overcome tight time constraints. This involved the use of precast concrete structures, prefabricated steelworks in long span structures, unitised curtainwall systems, aluminium façades, prefabricated sunshades and balustrades
- Extensive use of standardisation and modularity in conjunction with repetitive design to enhance buildability and ensure safety, quality and speed
- The use of vertical fibre drains and loading with surcharge to overcome the problem of high differential long term settlement due to underlying soft peaty and marine clay

# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## Civil Engineering Category

## FORT CANNING TUNNEL (MERIT)




| | |
|---|---|
| Qualified Person | Er Tan See Chee |
| C & S Consultant | T.Y. Lin International Pte Ltd |
| Builder | Sato Kogyo (S) Pte Ltd |
| Developer | Land Transport Authority |
| Construction Cost | $25.95 million |

### Challenges:

- The 350m long tunnel is the first road tunnel in Singapore. The overburden soil above the tunnel is shallow, ranging from 3m to 9m. The main challenge is the construction of the 15m wide by 11m high tunnel for the three-lane roadway in shallow overburden within the foot of Fort Canning Hill
- It was built in an urban area beneath roadways which were in service throughout the excavation period

### Solutions and Features:

- 180m of the tunnel were constructed by the Sprayed Concrete Lining (SCL) method, also known as New Austrian Tunneling Method (NATM)
- The unique choice of using SCL method was aimed at maintaining the recreational, serene and tranquil green environment of the park
- At both ends where overburden is less than 3m, cut-&-cover method using soldier piles with shotcrete lagging as a temporary retaining wall system was used

# DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARD

## Civil Engineering Category

## BISHAN SMRT DEPOT UNDERPINNING WORKS (MERIT)

| | |
|---|---|
| Qualified Person | Er Dr Yeoh Kiang Meng |
| C & S Consultant | MHW Consultants (s) Pte Ltd |
| Builder | Zap Piling |
| Developer | Land Transport Authority |
| Construction Cost | $14.95 million |

### Challenges:

- The project requires the extraction of 119 reinforced concrete piles and 97 steel piles underneath the existing Bishan Depot, as well as underpinning works, to facilitate the construction of the Circle Line Stage 3 tunnels from Lorong Chuan Station to Bishan Station that will be passing under it
- There was a lack of critical as-built information pertaining to the existing piles' penetration depth, depot deck design and details

### Solutions and Features:

- Good engineering judgment used in designing work. The consultant also engaged another top professional in the civil engineering field to assist in the design work. Analysis was also carried out to find out the effect of tunneling work on the existing Depot structure, such as soil movement and subsurface settlement
- Ground-monitoring instruments were used to monitor ground movements to ensure that they do not exceed the requirement of the SMRT that was in operation during construction
- Use of a highly qualified and competent team from both the consultant and the developer, working together with an experienced builder