

## **MEDIA RELEASE**

### **Recognising professional engineers for exemplary engineering design and safety**

**- *Clever design and safety combo nets prestigious awards for seven projects***

**2 June 2014** – Singapore is well-regarded as a place with safe infrastructure and buildings. This is made possible by the team of dedicated professionals behind the construction of a building, especially the professional engineers and their team members who are responsible for structural safety. This year, BCA is recognising seven professional engineers and their teams for their innovative design processes and solutions in overcoming project challenges.

2. For ingenuity in combining safety with aesthetic appeal, The Interlace was awarded the Design and Engineering Safety Excellence Award (DESEA) given by the Building and Construction Authority (BCA). The iconic residential condominium is one of the seven winning projects this year to be accorded recognition for exemplary engineering design feats and high safety standards in the structural design, construction and maintenance of buildings.

3. The Interlace has a unique stacking design which comprises eight large residential blocks arranged in a hexagon to form eight open and permeable courtyards. This is a breakaway from standard, isolated building designs. The stacked formations allow light and air to flow through the architecture and surrounding landscape.

4. There were two main challenges in designing this project. First is coming up with an innovative solution for long span transfer structures to carry the load of the six-storey blocks above them, as well as safely transfer the load to the two main cores of each block. The other challenge was to devise a construction method to facilitate the construction of the superblocks at height.

5. Led by Er. Serena Yap from T.Y.Lin International Pte Ltd, the team of engineers came up with innovative solutions to work around the challenges presented. Rigorous and comprehensive 3-Dimensional structural analyses were carried out to capture the overall building behaviour arising from the complex nature of the building layout. These analyses ensured the safety and robustness of the design. In the end, the team came up with a structural design that was not too heavy and optimised space for construction. Additionally, the use of high strength concrete helped minimise column size in order to optimise space usage.

6. In terms of construction safety, features which helped the development to garner the award included a fall prevention plan that incorporated safety induction for workers. Risk assessments were carried out for proprietary heavy duty shoring erection and dismantling process. The control measures and safe work procedures were also implemented for strict compliance. These helped The Interlace to achieve a stellar zero worksite accidents record.

7. Commenting on the achievements of the award winners, Er. Chew Keat Chuan, Group Director of Building Engineering, Building and Construction Authority said, “We live, work and play in buildings that have been put together by dedicated professionals which most people have taken for granted. As we build taller and deeper in a densely built-up environment, engineers will have to continually seek innovative, yet practical solutions to ensure that the structures can be built safely. The BCA Design and Engineering Safety Excellence Awards serve to recognise the outstanding achievements and commitment of the engineers who keep our buildings safe.”

8. Other award winners include Er. Soon Won Moi from Mott MacDonald Singapore Pte Ltd for the design of Downtown Line 1 C908 – Telok Ayer station and Er. Adrian Billingham/ Er. Lai Hock Sai for Marina Coastal Expressway C485.

9. The Downtown Line 1 C908 adopted the use of innovative “Trouser legs” concept for a design characterised by long diaphragm wall panels spaced at regular intervals for the cut-and-cover section of the tunnels. As these wall panels were designed to reach the hard soil strata at deeper depths, they acted both as

earth-retaining and foundation elements. This innovation shortened the construction period without comprising safety.

10. Meanwhile, some of the challenges the Marina Coastal Expressway C485 project faced included excavation under the seabed across the mouth of Singapore River through poor ground conditions comprising very deep deposits of soft, compressible marine clays. Part of the solution was to provide double row marine cofferdam with struts installed progressively to serve as temporary earth retaining structures for the excavation of the tunnel.

11. The other award winners include Er. Dr. Shahzad Nasim for Marina Bay Suites and Er. Ng Peng Yuen for Casa Clementi. Merit award winners are Er. Kam Mun Wai for Cube 8 Residences and Er. Ng Swee Tong for NUH Medical Centre.

12. For the full listing of winners, refer to Annexe A. Factsheets on the winning projects are in Annexe B.

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#### **About BCA**

The Building and Construction Authority (BCA) of Singapore champions the development of an excellent built environment for Singapore. BCA's mission is to shape a safe, high quality, sustainable and friendly built environment, as these are four key elements where BCA has a significant influence. In doing so, it aims to differentiate Singapore's built environment from those of other cities and contribute to a better quality of life for everyone in Singapore. Hence, its vision is to have "a future-ready built environment for Singapore". Together with its education arm, the BCA Academy of the Built Environment, BCA works closely with its industry partners to develop skills and expertise that help shape a future-ready built environment for Singapore. For more information, visit [www.bca.gov.sg](http://www.bca.gov.sg).

### **Annexe A: Winners' listing**

Five outstanding projects received the awards while two received merit commendations. The full list of winners is as follows:

	<b>Project</b>	<b>Award category</b>	<b>Winners – Qualified Person</b>	<b>Firm</b>
1	Marina Bay Suites	Award (Residential)	Er. Dr. Shahzad Nasim	Meinhardt (Singapore) Pte Ltd
2	The Interlace	Award (Residential)	Er. Yap Mui Cheng, Serena	T.Y.Lin International Pte. Ltd.
3	Casa Clementi	Award (Residential)	Er. Ng Peng Yuen	Surbana International Consultants Pte Ltd
4	Cube 8 Residences, Singapore	Merit Award (Residential)	Er. Kam Mun Wai	Meinhardt (Singapore) Pte Ltd
5	DTL1 C908 – Telok Ayer Station	Award (Civil Engineering)	Er. Soon Won Moi	Mott MacDonald Singapore Pte Ltd
6	MCE C485	Award (Civil Engineering)	Er. Adrian Billingham / Er. Lai Hock Sai	Worley Parsons Pte Ltd
7	NUH Medical Centre	Merit Award (Industrial & Institute)	Er. Ng Swee Tong	T.Y.Lin International Pte. Ltd.

## Annexe B: Fact sheets on winning projects

### DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARDS 2014 *Residential Category – Award*

#### *The Interlace*

	<b>Qualified Person</b>	<b>Er. Yap Mui Cheng, Serena</b>
	<b>C&amp;S Consultant</b>	<b>T.Y.Lin International Pte. Ltd.</b>
	<b>Builder</b>	<b>Woh Hup (Private) Limited</b>
	<b>Developer</b>	<b>Ankerite Pte Ltd</b>
	<b>Architectural Consultant</b>	<b>RSP Architects Planners &amp; Engineers (Pte) Ltd</b>

#### **Challenges**

- Interlocking blocks generate multi-directional stresses and deformation, which is not common in normal single block buildings. Under the loading from six-storey blocks, the main cores are subjected to forces in different directions at each Super Level stack. Therefore, the long and short term effects must be carefully considered in the analysis and design.
- A major challenge is to design a suitable long span transfer structure which will carry the six-storey residential block to span across the two main cores at the ends of the building, as well as to devise a suitable construction method to facilitate the construction of the superblocks at height.
- Optimisation of space utilisation within the units by controlling the structural sizes.

#### **Solutions and Features**

- Drawing on T.Y. Lin International's expertise in pre-stressing and bridge engineering, a 2.5m deep post-tensioned pre-stressed concrete box girder transfer deck was proposed as part of the value engineering exercise during the D&B tender. This system provides strong lateral and torsional stability with a clear load path to the foundations. The design eliminated the need for the thick and heavy spine and cross walls (original tender), reduced the overall weight of the buildings, freed up space within the units and supported the constructability of the development.

## **Annexe B: Fact sheets on winning projects**

- Rigorous and comprehensive structural analysis was an integral part of design development. The focus of this was to study and capture overall building behavior arising from the complex nature of the layout of the buildings and the magnitude of the project. This analysis included:
  - staged construction analysis was used to assess the impact on the main core that resulted from each stage of construction, especially at the transfer deck
  - global analysis - a full-scale 3D model of was built to obtain the interlocking force and moment envelope in mega columns
  - local analysis was used to provide the stress distribution for the transfer decks
- The construction methodology of the transfer deck was based on bridge engineering; adopting the established double cantilever for construction at height. Redundancy was built into the casting sequence so that after each stage of casting, the transfer deck would be self-supporting.
- High strength concrete of G80 was used in the mega columns to minimise the size of the columns as part of the space optimisation works.

## Annexe B: Fact sheets on winning projects

### DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARDS 2014 *Civil Engineering – Award*

#### Singapore Downtown Line Stage 1, Contract C908 Telok Ayer Station

	<b>Qualified Person</b>	<b>Er. Soon Won Moi</b>
	<b>C&amp;S Consultant</b>	<b>Mott MacDonald Singapore Pte Ltd</b>
	<b>Builder</b>	<b>Samsung-Soletanche Bachy France Joint Venture</b>
	<b>Developer</b>	<b>Land Transport Authority</b>
	<b>Architectural Consultant</b>	<b>ONG&amp;ONG Pte Ltd</b>

#### Challenges

- Excavation through poor ground conditions comprising thick layer of soft marine clay and in close proximity of existing structures such old pre-war shop-houses, office blocks and within busy CBD artery.
- Over-crossing of new Downtown Line (DTL) tunnels over existing twin bores of the existing East-West MRT line (EWL). DTL tunnels will rise to only 1.5m below the ground level, scraping across the top of the EWL tunnels with less than 1m clearance.


#### Solutions and Features

- Innovative design of “Trouser Legs” concept for diaphragm wall (D-wall) design, characterised by the long panels spaced at regular intervals for the tunnels. Long D-wall panels were designed to reach the hard soil strata at deeper depths and acted both as earth-retaining and foundation elements. This innovation shortened the construction period, which minimised disruption to public and enhanced public safety.
- Complex and innovative temporary works, design and careful sequencing for DTL tunnel crossing excavation above existing EWL tunnels which enabled the excavation and construction of the crossing to be carried out without adverse impact to EWL tunnels. The operation of EWL trains continued unceasingly throughout the construction of DTL & EWL crossing.

**Annexe B: Fact sheets on winning projects**

**DESIGN AND ENGINEERING  
SAFETY EXCELLENCE AWARDS 2014  
Civil Engineering Category – Award**

**Marina Coastal Expressway (Contract 485)**

	<b>Qualified Person</b>	<b>Er. Adrian Billingham Er. Lai Hock Sai</b>
	<b>C&amp;S Consultant</b>	<b>WorleyParsons Pte Ltd</b>
	<b>Builder</b>	<b>Penta-Ocean Construction Co., Ltd.</b>
	<b>Developer</b>	<b>Land Transport Authority</b>
	<b>Architectural Consultant</b>	-

**Challenges**

- Excavation under the seabed across the mouth of Singapore River through poor ground conditions, comprising very deep deposits of soft, compressible marine clays.
- Sequencing of open cut excavations within a 420m wide stretch of Marina Bay to ensure uninterrupted discharge from Marina Barrage.
- The scale of works associated with a 10-lane tunnel constructed within two large cofferdams.

**Solutions and Features**

- A portion of the Stage 1 cofferdam was left in place to allow connection of the Stage 2 works. The resulting “island” was stabilised at the transition face by a soil improved berm and progressively trimmed down as the Stage 2 cofferdam works progressed.
- Significant lateral loading was safely transferred back to ground by connecting the cofferdam longitudinal pipe pile walls with steel plates at the east end wall, thereby ensuring a stiff, stable load path.
- Comprehensive analysis of the tunnel temporary and permanent works was performed, including: 3-Dimensional Plaxis analysis of the cofferdam end walls; finite element analysis of the temporary pipe pile, and; thermal analysis of the tunnel to account for concrete casting sequence.




## **Annexe B: Fact sheets on winning projects**

- Collaboration between engineer and builder on safety features, such as left-in-place jacks to facilitate safe de-stressing and additional monitoring of base heave performance.

## Annexe B: Fact sheets on winning projects

### DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARDS 2014 *Residential Category – Award*

#### Marina Bay Suites

	<b>Qualified Person</b>	<b>Er. Dr. Shahzad Nasim</b>
	<b>C&amp;S Consultant</b>	<b>Meinhardt (Singapore) Pte Ltd</b>
	<b>Builder</b>	<b>Woh Hup (Private) Limited</b>
	<b>Developer</b>	<b>Marina Bay Suites Pte Ltd</b>
	<b>Architectural Consultant</b>	<b>Architects 61 Pte Ltd</b>

#### Challenges

- Design of a 245m high residential tower on reclaimed land and thick soft marine clay.
- The complex layout with a larger footprint, straddling across the existing Common Services Tunnel (CST) and box drain.
- Designing the building for safety, buildability and economy in a congested site, located next to existing MRT tunnels, CSTs, a 8-meter wide box drain and a new Underground Pedestrian Network, and completing the construction within 37.5 months.

#### Solutions and Features

- Devised an innovative deep perimeter belt beams system at refuge floors and innovative use of coupling beams at all floors to enhance building performance.
- Collaborated with architects to revise the building layout to a smaller footprint with a taller tower to eliminate the need for a deep transfer structure across the CST and box drain, saving substantial cost and time and mitigating any construction risk.
- Devised innovative Caisson-type sinking box method of strut-free and safe excavation for 9.2m deep lift pits.

## **Annexe B: Fact sheets on winning projects**

- Use of modular and repetitive structural system reduced typical floor cycle time to only six days while achieving a high CONQUAS score.

## Annexe B: Fact sheets on winning projects

### DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARDS 2014 *Residential Category – Award*

#### Casa Clementi

	<b>Qualified Person</b>	<b>Er. Ng Peng Yuen</b>
	<b>C&amp;S Consultant</b>	<b>Surbana International Consultants Pte Ltd</b>
	<b>Builder</b>	<b>Straits Construction Singapore (Pte) Ltd</b>
	<b>Developer</b>	<b>Housing &amp; Development Board</b>
	<b>Architectural Consultant</b>	<b>Surbana International Consultants Pte Ltd</b>

#### Challenges

- Effective design and construction of a large building project (for 2,234 dwelling units) within a small area in close proximity to existing housing estates, schools, MRT station and heavy traffic on adjacent roads.
- Coming up with innovative designs for the large semi-basement car park which provides direct access to all residential blocks, and for common green spaces on the eco-decks with community facilities for multi-generation users.
- Adopting a sustainable design with lower usage of concrete materials.
- Ensuring construction safety while minimising environmental impact.

#### Solutions and Features

- By adopting precast concrete design and fabrication, the goals of efficiency, productivity, constructability, delivery, quality, sustainability, safety and optimal environmental impact were achieved for the project.
- Strategic design of the large semi-basement car park with optimal platform level chosen to reduce earth works and without the need for extensive shoring system. It is naturally ventilated, lit and drained by gravity flow.
- Pile optimisation strategy adopted, which resulted in reduction in construction cost, concrete materials usage and time for piling works.
- Innovative construction safety systems implemented on site were three-tier climbing platforms, easy-to-install mesh barricades, hanging walkway, portable safety

## **Annexe B: Fact sheets on winning projects**

platforms and safety barriers. The builder also incorporated an innovative site water collection and recycling system to reduce water consumption and discharge of effluents to public drains.

## Annexe B: Fact sheets on winning projects

### DESIGN AND ENGINEERING SAFETY EXCELLENCE AWARDS 2014 *Residential Category – Merit*

#### Cube 8 Residences, Singapore

	<b>Qualified Person</b>	<b>Er. Kam Mun Wai</b>
	<b>C&amp;S Consultant</b>	<b>Meinhardt (Singapore) Pte Ltd</b>
	<b>Builder</b>	<b>Dragages Singapore Pte Ltd</b>
	<b>Developer</b>	<b>City Developments Ltd</b>
	<b>Architectural Consultant</b>	<b>ADDP Architects LLP</b>

#### Challenges

- Developing a basement and foundation system for the 36-storey tower with two basements for movement of 100mm for the future infrastructure tunnel retention system at close proximity to site.
- Designing the tower with ten-storeys of the building cantilevered 4.5m above Sky Terrace at Level 24.
- Designing the building for safety, buildability and economy in a congested site next to busy Thomson Road and PIE, at close proximity to the existing 35m wide box drain, adjacent to the future SURS and with poor soil conditions.

#### Solutions and Features

- Devised an innovative design after thoroughly studying several alternatives, assisted by extensive analyses. Replaced secant pile walls and barettes in the conforming tender to resist lateral movements by a simple retention system, yet managed to comply with requirements imposed on the Design & Build Contract, with substantial cost & time savings achieved.
- Use of innovative proprietary cantilever construction platform system to build the cantilevered portion of building above Level 24.
- Use of modular and repetitive structural system reduced typical floor cycle time to only six days while achieving a high CONQUAS score.

## **Annexe B: Fact sheets on winning projects**

- Extensive use of precast elements, Prefabricated Bathroom Units and system formwork to enhance buildability, constructability and productivity, making the construction faster and the site neater and safer.

**Annexe B: Fact sheets on winning projects**

**DESIGN AND ENGINEERING  
SAFETY EXCELLENCE AWARDS 2014  
Institutional and Industrial – Merit**

**National University Hospital Medical Centre**

	<b>Qualified Person</b>	<b>Er. Ng Swee Tong</b>
	<b>C&amp;S Consultant</b>	<b>T.Y.Lin International Pte. Ltd.</b>
	<b>Builder</b>	<b>Penta-Ocean Construction Co., Ltd.</b>
	<b>Developer</b>	<b>National University Hospital (S) Pte Ltd</b>
	<b>Architectural Consultant</b>	<b>Consultants Incorporated Architects + Planners</b>

**Challenges**

- The 19-storey Medical Centre with GFA of 72,000 m<sup>2</sup> above the existing Circle Line (CCL) tunnels and Kent Ridge Station was designed with load provision for a 7-storey building only.
- Undulating site terrain involving 14m deep excavation in both basement and spiral ramp construction.
- Construction activities next to existing Kent Ridge Wing and main building.

**Solutions and Features**

- Designed the steel transfer structures to be supported on two rows of mega composite columns for an additional ten levels to bridge over the station.
- Adopted hybrid ground anchors as earth retaining and stabilising structures system and top-down method of construction in design to meet the movement criteria and to safeguard the adjacent buildings, MRT structures/ tunnels and the adjoining roads.
- Designed for off-site fabrication of structural steel works to mitigate vibration and noise generated by construction activities and installed real time noise monitoring system at the hospital with SMS alerts.