DESIGN AND ENGINEERING SAFETY AWARD 2019

Institutional & Industrial – Excellence

National Centre for Infectious Diseases and Centre for Healthcare Innovation

Qualified Person	**Er. Kam Mun Wai**
C&S Consultant	**Meinhardt (Singapore) Pte Ltd**
Builder	**Kajima Overseas Asia (Singapore) Pte. Ltd.**
Developer	**Ministry of Health**
Architectural Consultant	**CPG Consultants Pte. Ltd.**

Challenges

- Deep basement construction (up to 24m) in highly variable Jurong Formation
- Unbalanced excavation due to undulating ground terrain 15m across site
- Construction of 3 numbers of deep underpasses below Jalan Tan Tock Seng
- Erection of 3 bridges to provide inter-building connectivity to Tan Tock Seng Hospital and Lee Kong Chian (LKC) School of Medicine
- Close proximity to existing hospitals, LKC conservation building and surrounding residential developments
- Fast track programme

Solutions and Features

- Innovative and robust Earth Retaining/Stabilising Structures (ERSS) comprising contiguous bored pile wall and full top down construction method to minimise wall deflection, ground movement and water drawdown. This had resulted in the safe execution of the 4-level basement construction, without adversely affecting the integrity of adjacent sensitive properties and structures.

- Adoption of full top down method to enable excavation and superstructure construction concurrently due to the fast track programme

- Hybrid piled raft foundation system maximising the favourable ground condition resulting in time and cost savings to the foundation

- Flat slab system for basements to facilitate full top down construction and enhance buildability and productivity

- Highly buildable, repetitive and standardised semi-precast system with band beams and hollow core slabs for the superstructure, designed for future proofing

- Robust and practical Earth Retaining/Stabilising Structures (ERSS) system for the construction of the 3 underpasses, involving multi-staged road diversion of Jalan Tan Tock Seng.

- Light weight composite steel trusses with segmental and sequential erection enabling safe construction of the bridges over the busy Jalan Tock Seng Seng road.

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Institutional & Industrial – Excellence

My First Skool Large Childcare Centre at Punggol Dr

Qualified Person	**Er. Lauw Su Wee**
C&S Consultant	**LSW Consulting Engineers Pte. Ltd**
Builder	**Kwan Yong Construction Pte Ltd**
Developer	**NTUC First Campus Co-Operative Limited**
Architectural Consultant	**LAUD Architects Pte Ltd**

Challenges

- It is a fast track project aiming to deliver the building in one year for the operation of the new childcare centre in time;
- The building is of irregular shape, like two “seashell” pivoting around the centre point;
- The building also featuring a 12m height, curved glass façade supported by steel framing, at the back of each “seashell”;
- The client would like to have a more open space and lesser columns for flexibility and re-partitioning of the rooms in the near future;

Solutions and Features

- Full precast floor system with precast pre-tensioned rib beams and powerdek as left in formwork, such that the basic structure of the 2-story building with roof terrace was completed within 3 months;
- Long span (up to 18m) post-tensioned curve main beams was adopted, so as to give more column free space within the building;
- DfMA solution for the 12m height curve façade, with standardized and repetitive vertical and horizontal trusses, fabricated in the factory and assembled on site.

DESIGN AND ENGINEERING SAFETY AWARD 2019

Institutional and Industrial – Merit

Assisi Hospice

Qualified Person	**Er. Tan Wai Houng**
C&S Consultant	**Meinhardt (Singapore) Pte Ltd**
Builder	**Soil-Build (Pte). Ltd.**
Developer	**Assisi Hospice**
Architectural Consultant	**New Space Architects Pte Ltd**

Challenges

- Site has surrounding constraints with existing MRT Circle Line tunnels, Marymount Flyover, MacRitchie Viaduct, Thomson Road, Future MRT Thomson Line, Future North-South Expressway tunnels.
- Unbalanced excavation due to undulating ground terrain with 10 m difference next to existing Assisi Hospice.
- Long span link bridge connecting north and south of building, at 4th storey.

Solutions and Features

- Robust Earth Retaining Stabilising System (ERSS) comprising sheetpiles with partial excavation on 2 sides and secant bored piles on 2 sides, strutted to central basement structure / island. Analysis carried out incorporated movement limits by LTA. Detailed 2D and 3D finite element modelling was carried out systematically to analyse and design the SBP system.
- The robust ERSS minimises the impact of ground movement to neighbouring properties, including sensitive structures such as MRT Circle line tunnels, fly over viaduct structure and existing Mount Alvernia hospitals and Assisi Hospice structures. The use of SBP instead of conventional cut and cover method

mitigate the impact of ground movements, vibrations, existing structure movements etc.

- Repetitive flat plate structural system designed for typical ward levels, minimising floor-to-floor height, construction time, and enhancing site productivity and construction safety.

- Extensive coordination on routing of M&E services with ceiling spaces and provision of penetration through slabs and beams using BIM, and extensive collaboration of Consultants, Builder and Client throughout design and construction stages to meet Client requirements.

- Composite steel floor system for the link bridge to enhance buildability, productivity and safety in construction.

DESIGN AND ENGINEERING SAFETY AWARD 2019

Civil Engineering – Merit

Contract 1688- Construction of Station EW30 and Viaduct for Tuas West Extension

Qualified Person	**Er. Rengasamy Selvaraju**
C&S Consultant	**AECOM Singapore Pte Ltd**
Builder	**Shanghai Tunnel Engineering Co (Singapore) Pte Ltd**
Developer	**Land Transport Authority**
Architectural Consultant	**Aedas Pte Ltd**

Challenges

- 4 level Interchange Station above live 6-lane roadway (2 carriageways).
- Continuous long, 5 spans (53m-75m-75m-75-53m) with curved alignment at the crossing of Pan-Island Expressway along Tuas Road, where the rail viaduct will be constructed over live traffic.
- Construction of the rail viaduct that crosses over an existing road viaduct at Ayer Rajah Expressway at a height of 21m over busy live traffic.
- Limestone cavity encountered during construction of piling.

Solutions and Features

- Main RC frames cast-in-situ every 25m to piled foundations and PSPC girders as main floor elements between frames. Use of PC planks / metal decking between PSPC beams. The roof is a steel diagrid modular truss system erected on site. Many stages of traffic diversions carried out to construct foundations and use of lifting equipment where necessary.

- Using the balance cantilever method over the live Pan-Island Expressway with the segmental post tensioned precast beams across. This Method adjusts for changes in pier distances and suitable for curved spans. Also, the system minimises construction and footprint over live traffic and Work can be staged to suit ongoing traffic conditions.

- The span-by-span technique is employed to construct the rail viaduct over an existing road viaduct at Ayer Rajah Expressway. The beams were launched at 21m above ground at 36m long span and maintaining a safe working environment at height with no impact on the AYE

- Additional probing has been carried out at every pile proposed at the cavity prone location to ensure the cavity depth from ground level and the pile design was revised accordingly. Permeant casing are provided from ground level and terminate below 500mm from the bottom of cavity.