DESIGN AND ENGINEERING SAFETY AWARD 2023

Commercial

lyf one-north Singapore

Qualified Person	**Engineer Teoh Eng Sin**
C&S Consultant	**Mott MacDonald Singapore Pte Ltd**
Builder	**Nakano Singapore (Pte) Ltd**
Developer	**DBS Trustee Limited (As Trustee Of CapitaLand Ascott Real Estate Investment Trust)**
Architectural Consultant	**WOHA Architects Pte Ltd**

Challenges

- Engineering a three-storey link bridge building, to connect two L-shape, seven-storey buildings, from the 5th to 7th storey.
- Tight and narrow sloping site, with a height difference of 5m, from front (Portsdown Road) to back (Nepal Hill), along with a section of the site being only 20m above the two Circle Line (CCL) MRT tunnels.
- Site restrictions included a five-storey unobstructed viewing and ventilation corridor (Government Land Sales requirements) to the conserved bungalows, within proximity to edge of slope.

Solutions and features

- The elevated swimming pool is supported on a shallow foundation directly above the CCL MRT tunnels. This was needed to free up the site, outside the 1st reserve for the whole building pile foundations. Our team used 3D finite element analysis to ensure minimum impact to the CCL tunnels and verified this through automatic tunnel monitoring system.

- Collaborative team design development. This led to the creation of the three steel plate girders and slanted steel column support structure. This design achieved minimum obstruction to the viewing and ventilation corridor and a safer build programme.
- The transfer plate girders and slant columns being critical elements, were designed with redundancy to code compliance for a safe and robust design, protected with fireproof paint and exposed as part of building features.
- Adopting soil nail temporary stabilised slope with glass fibre reinforced polymer (GFRP) bar as earth retaining stabilising structure (ERSS) for excavation, detail instrumentation where monitoring confirmed minimal ground movement and the bungalow structure at higher ground was unaffected by the excavation.
- Our team designed the gravity detention drain system at high ground, removing the need for underground tank and pumps, which lead to capital cost and energy saving.

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Institutional & Industrial

Kallang Polyclinic and Long-Term Care

Qualified Person	**Engineer Lim Keong Liam**
C&S Consultant	**Arup Singapore Pte Ltd**
Builder	**Tiong Seng Contractors (Pte) Ltd**
Developer	**Ministry of Health**
Architectural Consultant	**RDC Architects Pte Ltd**

Challenges

- Design and construct a barrier-free public healthcare and long-term care facility with seamless and sheltered connectivity to main public transport node within a congested and land-locked site flanked by a conservation building.
- The development was to cater specially for a prominent visual landmark at main entrance, which is a shared entryway with adjacent building, while ensuring sufficient green space and outdoor seating amidst space constraints with ¼ of 4,000 sqm site situated over 1st Railway Reserve Line (RRL) zone that is partially bisected by twin bored tunnels.
- The superstructure expected to be erected within a challenging and tight 26-month construction timeline.

Solutions and Features

- Geotechnical investigations and analyses were carried out to provide a robust notional excavation scheme that would not impact the tunnel structures. The overall building form was also extensively studied and set back from the first reserve to bypass this constraint.
- Design for manufacturing and assembly (DfMA) techniques, including precast, PPVC, and structural steel elements, were integrated into the superstructure to align with the accelerated construction programme. The team had reduced the modules to five types, optimising repetition of modules for production. Five storeys of the superstructure comprising of 131 modules were installed within just four weeks.

- Employed steel Prefabricated Prefinished Volumetric Construction (PPVC) due to its lightweight nature, reducing crane usage and streamlining module connections. Factory-made PPVC modules, featuring welded intra-module connections, were bolted together on-site. This modular strategy facilitated simultaneous construction of long-term care modules and the polyclinic, accelerating construction productivity and workmanship, reducing man-hours on-site, and minimising disruptions to Kwong Wai Shiu Hospital and surrounding HDBs through better noise and dust control.

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Residential

Whistler Grand

Qualified Person	**Er. Heng Kim Huat**
C&S Consultant	**TW-Asia Consultants Pte Ltd**
Builder	**Woh Hup (Private) Limited**
Developer	**CDL Pegasus Pte Ltd**
Architectural Consultant	**ADDP Architects LLP**

Challenges

- To understand the concept & constraints and design of suitable Prefabricated Prefinished Volumetric Construction (PPVC) system
- Quality Assurance and Quality Control (QAQC) and coordination of PPVC modular works
- Handling of large and heavy PPVC modules
- Presence of non-typical Sky Terrace platform at typical PPVC floor

Solutions and Features

- Early engagement with builder and project team to achieve a common mindset and necessary technical capabilities which is crucial for the adopted PPVC system to be successful and cost effective. Design for standardisation of units which helps to achieve effectiveness of PPVC system while using innovative 'Composite Shear Wall System(patented)' helps maximise user-friendly room area and usage.
- Working with Builder to ensure accurate fabrication of carcass of the PPVC modules (dimensional controls using 3-D steel mould casting) and accurate site installation (survey controls for levelling and verticality). Coordinating closely with Builder to ensure the whole PPVC construction cycle is smooth and seamless.
- Early planning & study on the heavy-duty crane hoisting capacity and transportation routing to comply with the LTA's requirements.

- Facilitating Builder to adopt use of large-piece 'integrated precast slab-beam element' for construction of non-typical Sky Terrace extension platform over the void to eliminate the use of conventional formwork system.