Evening Talk on "Oversoming the design and construction for the Crossrail Canary Wharf Station"

by Ir. Yee Thien Seng

Ir. Yee Thien Seng is currently the Chairman of IEM Geotechnical Engineering Technical Division (GETD).

An evening talk jointly organized by IEM GETD and the Malaysian Geotechnical Society on 'Overcoming the Design and Construction Challenges for the Crossrail Canary Wharf Station' was presented by Dr. Yeow Hoe Chian on 7 August 2015 at the Tan Sri Professor Chin Fung Kee Auditorium, Wisma IEM, Petaling Jaya. It commenced at 5.30 pm and was attended by 51 registered participants.

The talk was centred on the construction of the underground station box in the old North Dock site at Canary Wharf, London for the Crossrail line ahead of the arrival of tunnel boring entering the station. The station box construction proper commenced in June 2010. It had to be engineered to counter buoyancy from the dock water.

In the original tender scheme, the excavation was to be supported by a double-skin sheetpile cofferdam. However, Dr. Yeow described that the adopted innovative alternative design/construction for the cofferdam used the combined interlocking 1,219mm diameter steel tubular piles over a contiguous bored pile wall system and the plain contiguous bored pile wall along the north and south sides of the cofferdam respectively. He elaborated that the tubular piles only extended below the upper sand and gravel aquifer formations into the underlying clay bed to exclude the flow of the dock water into the excavation. The steel tubes were installed by a hydraulically jacked-in system. Reinforced concrete bored piles were then constructed through the annulus of the tubular piles to extend the cofferdam wall below the steel tubes as shown in Figure 1.

The cofferdam had to support 9m depth of dock water plus the 18m excavation below the dock bed – making it a 27m maximum height of lateral loading on the north cofferdam walls. After closing off the dock water at the west end of the construction by exploiting the presence of old cofferdams, the south cofferdam wall along the existing Canary Wharf buildings did not have to support lateral loading from the dock water. This resulted in assymetrical loading in the overall system; the consequences of which had to be evaluated. Dr. Yeow showed the results of the evaluation which was accomplished by finite element analyses.

An absence of internal temporary propping was achieved by supporting the north cofferdam wall with the use of external anchor piles and pretensioned inclined tie-rods for dewatering of the dock water inside needed to construct the station box roof slab at approximately the old dock bed elevation. Thereafter the station box was constructed using the top-down construction process with excavation taking place beneath the completed immediate floor above to progressively prop the cofferdam walls internally.

The cofferdam performance was extensively monitored. Monitoring measurements showed the anchored tubular piles deformations had breached the first computed trigger limits during the course of the station box construction and necessitated the trigger limits to be re-established. Piezometric levels in the lower aquifers were observed to have lowered by as much as 20m as the result of dewatering for the station box construction. Dr. Yeow stated that the station box was successfully completed in time for the arrival of the bored tunnels in August 2012.

The talk was concluded at 7.15 pm with Dr. Ooi Teik Aun presenting a token of appreciation to Dr. Yeow following a brief Q&A session.

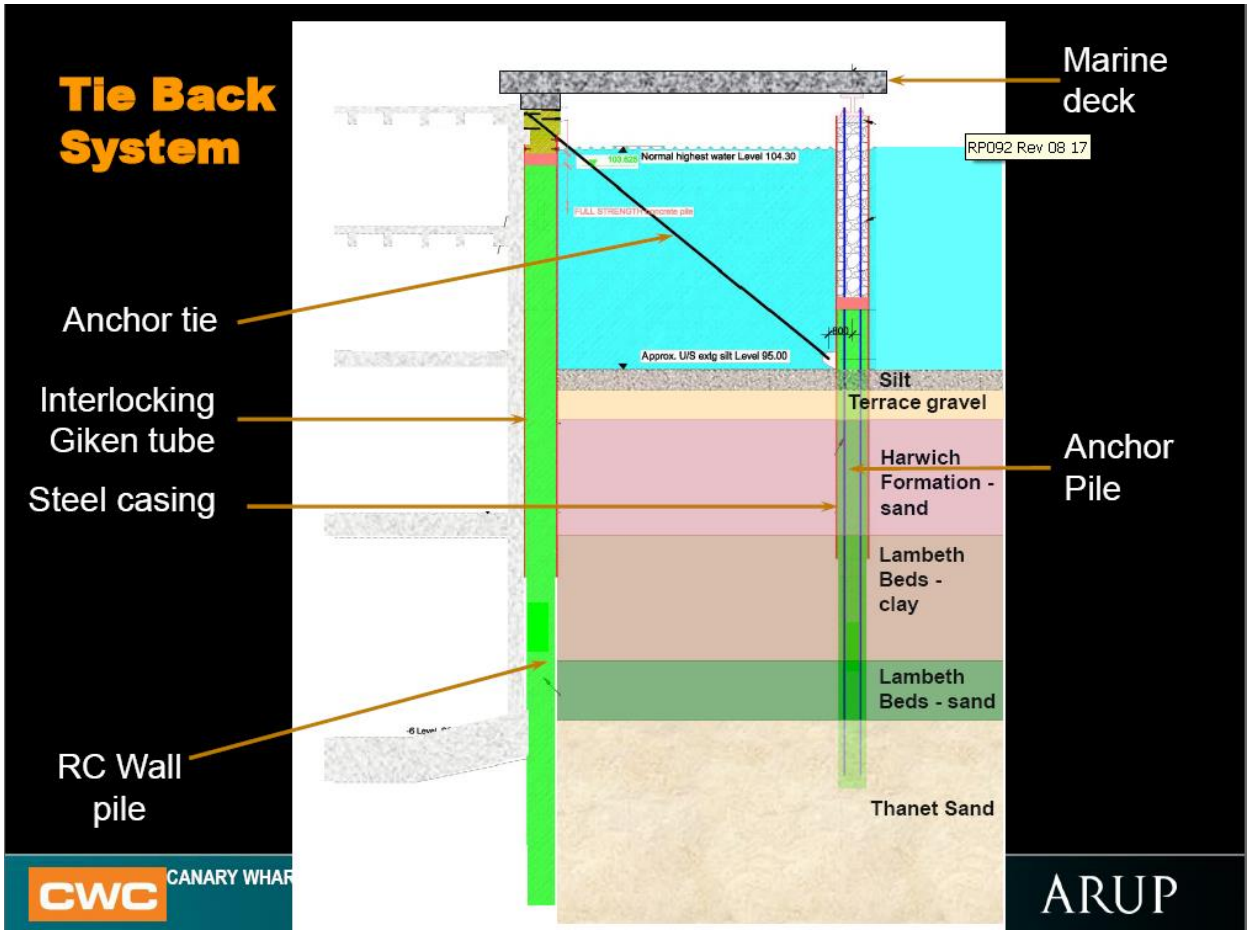

Figure 1. The anchored tubular pile wall cofferdam.