G481 – THE HERMINGTON @ KUCHAI LAMA

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Project Introduction

The Hermington is a prestigious project by Aset Kayamas, comprising of 479 residential units and located just a short distance from downtown Kuala Lumpur. To be more precise, the project site is situated on sloping terrain adjacent to NPE Highway, in which the topographical ground level varies from 74mRL to 29mRL.

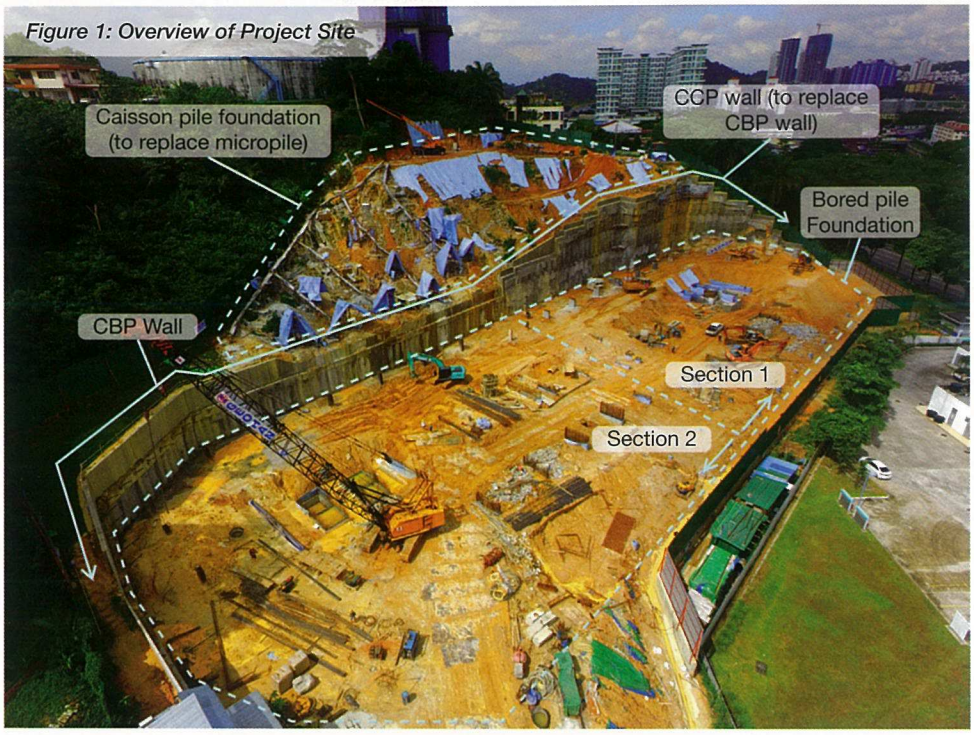

Figure 1: Overview of Project Site

The proposed foundation system of the 46-storey high-rise condominium is a combination of bored pile foundation with pile diameter ranging from 600mm to 1800mm, and micropile foundation with pile diameter of 300mm. Owing to hilly terrain, permanent earth retaining structure is necessitated to enable excavation and subsequently construction of sub-basement structures. Contiguous piled wall with appropriate propping system was introduced to facilitate the deep excavation, in view of the low groundwater table, high cost effectiveness and the availability of bored pile machine planned for foundation works. The excavation sequence is generally amalgamation of bottom-up and top-down approach with one (1) level of temporary steel strut, two (2) levels of temporary ground anchors and one (1) level of permanent concrete slab to support the most critical concrete piled wall section with maximum retained height of 22 meters.

Our scope of works covers bored pile, micropile, pilecap, contiguous bored pile (CBP) wall, capping beam, plunge-in column, temporary ground anchor, temporary steel strut and soil nailed slope. The overall construction duration allocated is 10 months with sectional handover of 7 months for Section 1 followed by Section 2.

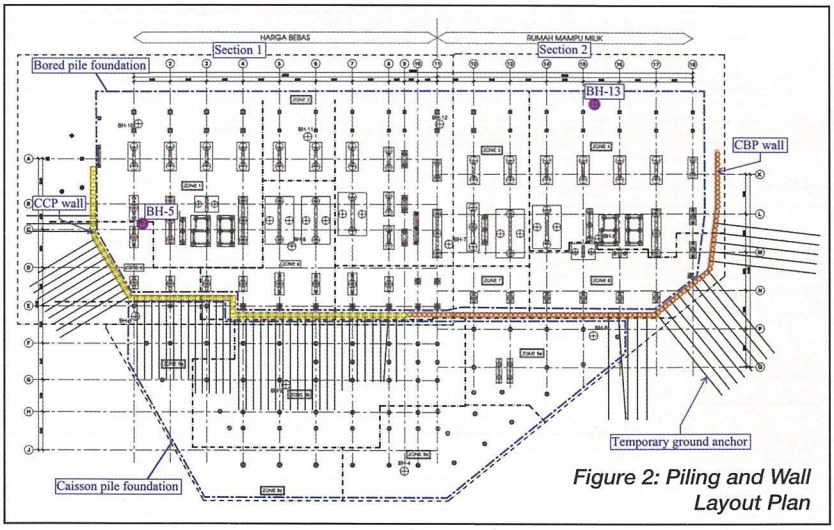

Figure 2: Piling and Wall Layout Plan

Alternative Design Proposal and Design Challenges

As revealed from the available soil investigation (SI) information, the project site is underlain by both granitic formation and Kenny Hill formation as shown in Figure 3. These substantially different geological formations were verified from exploratory boreholes (Figure 4), which demarcates the site into two (2) geological zones.

Upon award of contract, the embedded wall alignment was shifted

Figure 3: Geological Map of KL

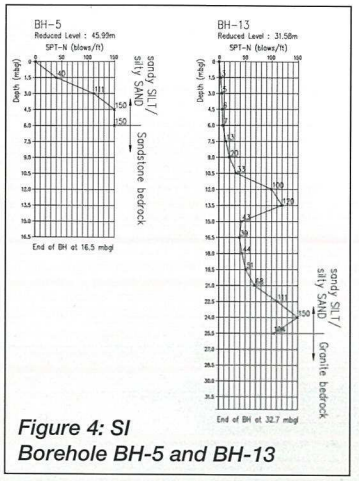

Figure 4: SI Borehole BH-5 and BH-13

towards the higher ground due to architectural requirement, resulting in larger wall retained height and logistic difficulties in preparing working platform for boring machine, especially at the highest ground in Section 1. Thus, we had proposed to convert CBP wall in Section 1 to contiguous caisson pile (CCP) wall where pile installation works at arduous terrain are feasible. The design of CCP wall was carried out in collaboration with the consultant engineer where analysis result from finite element (FE) software namely Plaxis 2D and FLAC 3D were implemented. By referring to the latest data of inclinometer installed behind the most critical CCP wall section, the relatively small wall lateral displacement (i.e. <10mm) indicated that the wall design was conducted adequately with full engineering judgement and practice.

Prior to installation of temporary corner steel strut of CCP wall, it was discovered that the configuration of steel strut is ineffective in propping the wall due to wide angle of turning corner. In view of this limitation, we had counter-proposed to replace the steel strut with wall tie-back system using two (2) layers of temporary soil nail. The decision was speedily firmed up and the entire installation process was completed within 10 days.

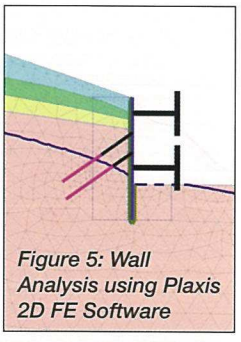

Figure 5: Wall Analysis using Plaxis 2D FE Software

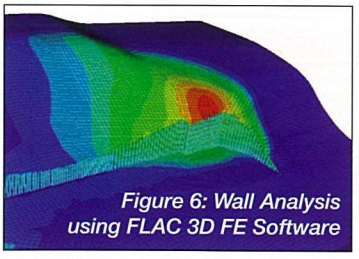

Figure 6: Wall Analysis using FLAC 3D FE Software

The foundation of building podium on the retained side of CBP or CCP wall was originally micropile pilegroup as planned by the consultant engineer. However, in order to minimize ground disturbance on top of contiguous piled wall, we had suggested to convert all the micropile foundations equivalently to caisson pile. The caisson pile design parameters were finalized judging from the result obtained from preliminary bored pile tested earlier, as below: -

a) Ultimate unit shaft friction, fsu for soil
   - 3NforSPT-N<50
   - 2.5Nfor50≤SPT-N<100 ⊠ 2NforSPT-N≥100
   - limited to maximum 400kPa

b) Ultimate unit end bearing, fbu for soil
   - 20N, limited to maximum 4,000kPa

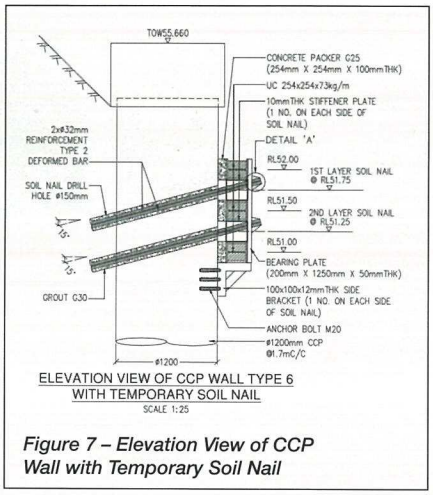

Figure 7 – Elevation View of CCP Wall with Temporary Soil Nail

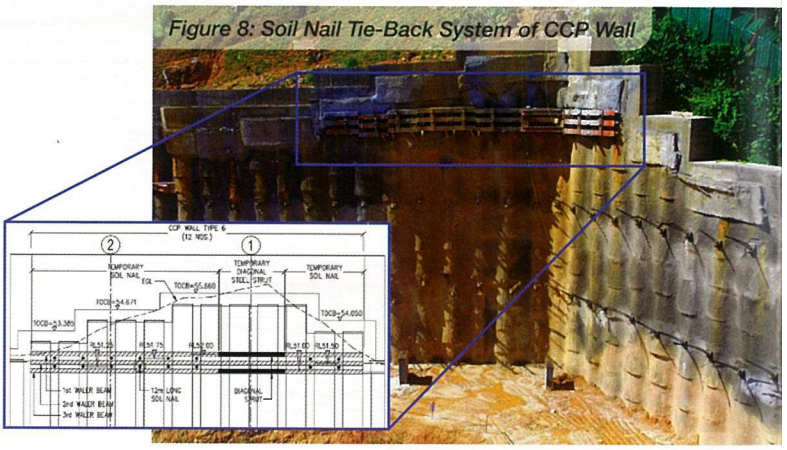

Figure 8: Soil Nail Tie-Back System of CCP Wall

The design parameters were then verified via caisson shaft load test and caisson plate bearing test in a selected working caisson pile. Generally, the concrete lining displacement was recorded as 0.65mm at 2 × working load (WL) and plate settlement was recorded as 15.72mm at 3×WL. In other words, the design parameters were proven to be acceptable. Despite longer construction duration required for caisson pile, the entire caisson foundation construction took about three (3) months with two (2) cycles, thanks to comprehensive planning by our site operation team.

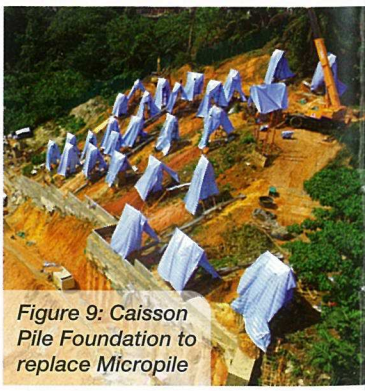

Figure 9: Caisson Pile Foundation to replace Micropile

Operation Issue and Construction Difficulties Encountered

As highlighted earlier, the original CBP wall at Section 1 was converted to CCP wall due to steep hillyterrain where platform preparation for heavy boring machine may entail massive earthwork and associated possible safety or slope stability issues. As consequence, the construction period for the embedded wall is prolonged and subsequently affecting the bored pile works in Section 1, which can only be commenced after cutting the platform to the design level (~19m high) upon completion of CCP wall and two (2) levels of temporary ground anchor (Figure 10).

Figure 10: Excavation Works after Completion of CCP Wall

In order to mitigate the possible delay, we had performed our due diligence by adding more caisson resources to expedite the progress of CCP wall and reverse the sequencing by early start of Section 2 foundation works albeit it may impede the site logistics.

In addition, the construction of plunge-in column (PIC) for permanent concrete slab on such a narrow platform (**Figure 11**) is another challenge that we encountered. Logistic planning is imperative and a steel frame was deliberately fabricated to fix the I-beam in position and its as-built position was checked immediately after the casting to ensure the PIC is precisely placed.

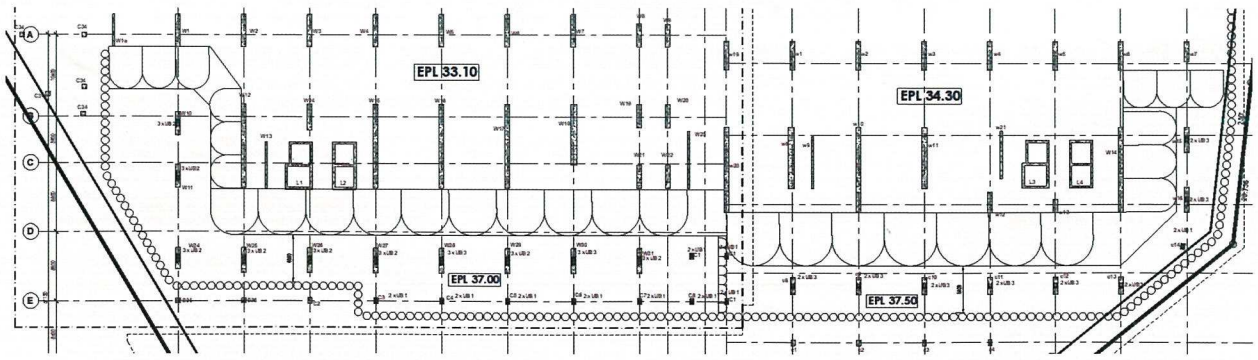

Figure 11: PIC Layout Pl

Not with standing the above difficulties and challenges, we are still able to deliver the project about a month ahead of schedule in overall.