G493 – Sunway Velocity 2 @ Jalan Peel

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Project Introduction

Sunway Velocity TWO (Plot A) is a fully-integrated and transit-oriented development by Sunway Property located diagonally across Sunway Velocity, which comprises of 2 residential towers (53 storeys) and an office tower (28 storeys). The project site is strategically situated with distance of 3.8km from KL city center and directly linked to 3 MRT stations. Prior to commencement of construction activities, the project site was a land with relatively consistent topographic levels ranging from 42mRL to 43mRL.

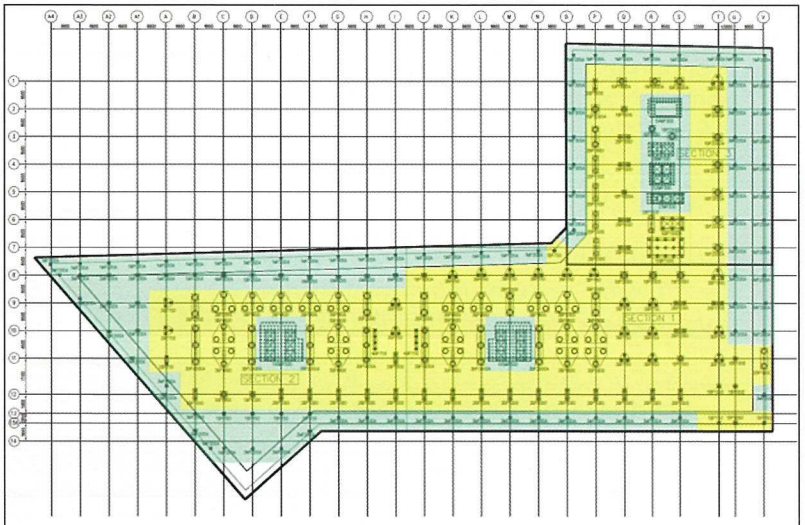


Figure 1 – Foundation Layout (Conforming Design)

The proposed foundation system as per the consultant's conforming design was a combination of bored pile foundation with pile diameter ranging from 750mm to 2000mm, and micropile foundation with pile diameter of 200mm to 300mm. (Figure 1) Geohan's scope of works covers earthwork, piling, pilecap, basement slab and retaining wall. The hand-over schedule of the project site was divided into 3 sections, namely Section 1 (6 months), Section 2 (8 months) and Section 3 (11 months).

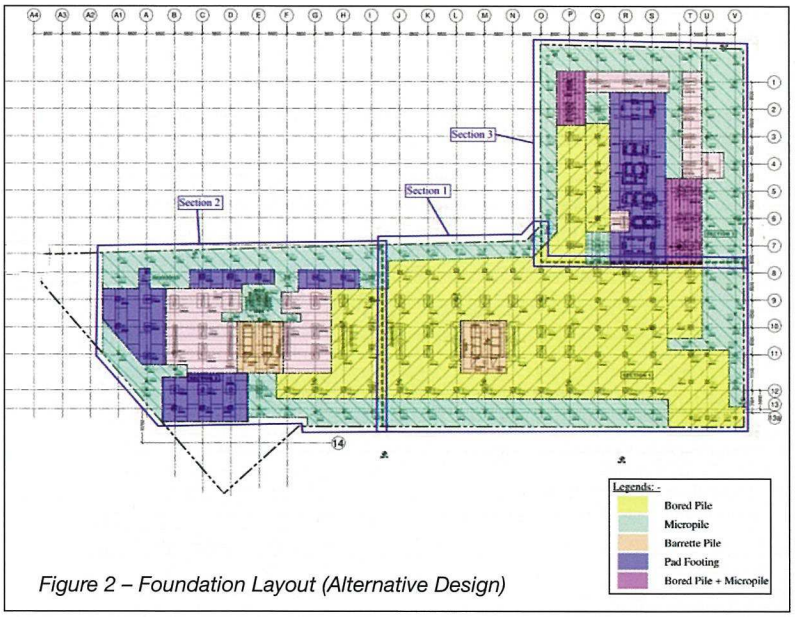
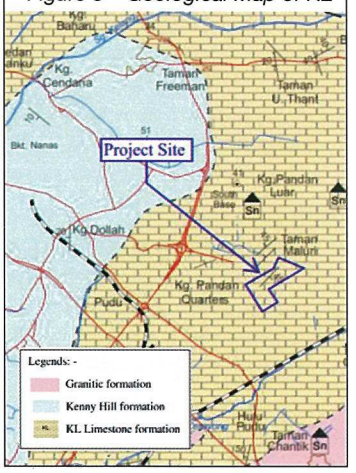


Figure 2 – Foundation Layout (Alternative Design)

Upon award of contract, we had offered our design & build proposal, to diversify the foundation systems into a combination of bored pile, micropile, barrette pile and pad footing. (Figure 2) Barrette pile and pad footing are generally caisson of rectangular/ square shape, constructed using hydraulic breaker to form the desired dimensions. With different construction method and equipment, the various foundation works can be proceeded concurrently in order to tackle for the relatively tight construction duration.

Figure 3 – Geological Map of KL



Alternative Design Proposal and Design Challenges

As revealed from the available soil investigation (SI) information the project site is underlain by KL Limestone formation (Figure 3) where typical karstic features such as undulating bedrock level and cavity are expected. Nonetheless, the project site had undergone cavity treatment works using compaction grouting prior to commencement of foundation works and this had eliminated some of the challenges due to subsurface uncertainties.

In view of shallow bedrock level and the nature of soft overburden soil, all piled foundations were designed to socket into Limestone bedrock. Generally, the design rock socket length of bored pile was optimized from 4 times piledіameter (i.e. 4D) to 3D in our alternative proposal. The design parameters were successfully justified from the instrumented maintained load test (MLT) where the pile top settlement was 2.62mm at 1 time working load (i.e. 1×WL), 5.38mm at 2×WL and 9.08mm at 2.85×WL. The maximum rock shaft friction achieved were as large as 2,000kPa. Preliminary MLT for micropile also demonstrated superb pile performance as the pile top settlement recorded was 6.95mm at 1×WL, 16.15mm at 2×WL and 20.26mm at 2.32×WL.

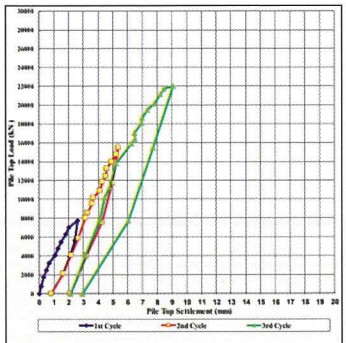


Figure 4 – Preliminary MLT Result for Bored Pile

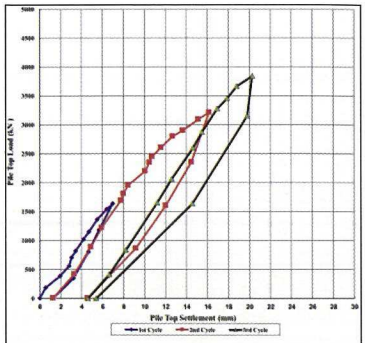


Figure 5 – Preliminary MLT Result for Micropile

Unlike typical excavation sequence where the deepest structures (i.e. liftcore) will be constructed prior to the rest, our operation team had made a firm decision to execute bulk rock excavation at Section 2 and 3, in order to facilitate simultaneous construction of pad footing, barrette pile and liftcore structures. (Figure 6) Apart from rock head contour generated from the available SI & cavity probing works, our site team had taken initiative to carry out rock probing at most pad footing locations to ascertain the feasibility of the chosen foundation system. In this aspect, a continuous feedback from site team and close collaboration with the design team were the key in ensuring successful foundation design and execution of works at site.

Figure 6 – Overview of the Project Site (January 2019)

Figure 7 – Deep Excavation of Liftcore

As the deep rock excavation (>6m) is inevitable for liftcore pilecap construction of conforming micropile pilegroup, we had counter-proposed to convert the piled foundation to pad footing, which is even more economic in terms of construction duration without jeopardizing the foundation performance. This had been justified via 2 nos. of plate bearing test where the plate top settlement was insignificant (i.e. < 1mm) after loaded to 3×WL. In terms of engineering innovative, it is also noteworthy that our project manager, Ir. Jeremy Lim had proposed a top-loaded setup (Figure 8) for shaft load test for justification of design parameters for barrette pile, in contrast to typical setup inside the caisson/ barrette. The element under testing was a 1m pile entity with 300mm polyfoam below it for discounting the end bearing contribution. A vibrating wire strain gauge located underneath the pile entity had proof that there was no load transferred to the pile base and the objective of testing had met. The recorded pile top movement was less than 1mm upon loaded to 2.5×WL.

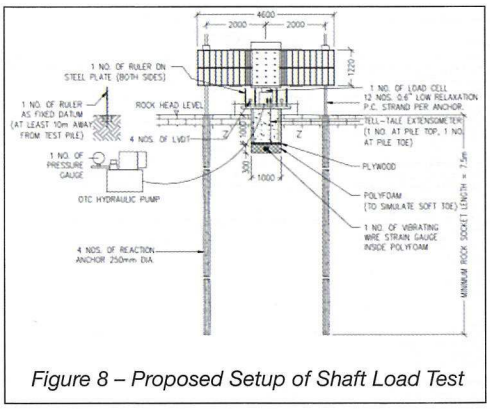


Figure 8 – Proposed Setup of Shaft Load Test

Owing to mutual-understanding among the project team and comprehensive coordination by project manager, the project was able to be delivered ahead of the targeted schedule.