

G497-IOI CITY MALL 2 @ PUTRAJAYA

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Project Introduction

IOI City Mall 2 is a project by Mayang Development Sdn Bhd/ IOI Resort City. The project is located next to the existing IOI City Mall building at Putrajaya and the development project comprises of 1 commercial complex, 3 blocks of office towers, 2 blocks of hotel building and 3 basement carpark. The building foundation system is a Contractor's Alternative Design which consists of 985 nos. of bored piles with sizes ranging from 600mm to 2500mm diameter. The contract construction duration is 23 months which includes piling and pilecap works. The hand-over schedule of the project site was divided into 3 sections, namely Section 1A (5 months), Section 1B (6 months) and Section 2 (12 months).



Figure 1: Site Aerial View

Alternative Design Proposal

Initially, full bored pile foundation system was proposed. However, existing bored pile was discovered under the existing bridge in Section 1B, thus 65 nos. of micropile foundation system was introduced for ease of piling works and to expedite the site progress. Furthermore, due to the changes in column loadings and additional columns was released by the Consultants during piling works which makes the total bored piles number increased from original 985 nos. to 1214 nos. and 178 nos. of micropiles in total.

Design Challenge

Based on the subsurface investigation (SI) summary, the geological profile of the site is mainly consisting of hard sandy SILT and underlain by Sandstone. For optimum design, the pile length design is based on S.I bored hole influence area method and each pile was designed to column loading instead of its structural capacity. All piles were designed based on soil friction and end bearing. The pile length of each individual pile is indicated in the piling layout for easy implementation.

From the instrumented test pile result, we were able to achieve soil skin friction of $3 \times \text{SPT-N}$ (kPa) for $N < 50$, $2.5 \times \text{SPT-N}$ (kPa) for $50 \leq N < 100$ and $2.25 \times \text{SPT-N}$ (kPa) for $100 \leq N < 200$ and ultimate end bearing capacity of 1200kPa. The total pile top settlement and total pile base settlement at $3 \times \text{WL}$ is 14.96mm and 3mm respectively. Thus, we believe the pile can achieve higher ultimate end bearing capacity as it is not fully mobilised yet.

The most challenging part of this project during design stage is each pile needs to design to column loading instead of its structural capacity based on the S.I borehole influence area. Imagine for a total piles of 1392 (bored pile and micropiles), each of the pile length needs to design individually. In view of column loading changes and additional columns released partly by the Consultant, the overall foundation system has significantly changed from the tender stage in terms of total numbers of piles, type of foundation system and pile sizes.

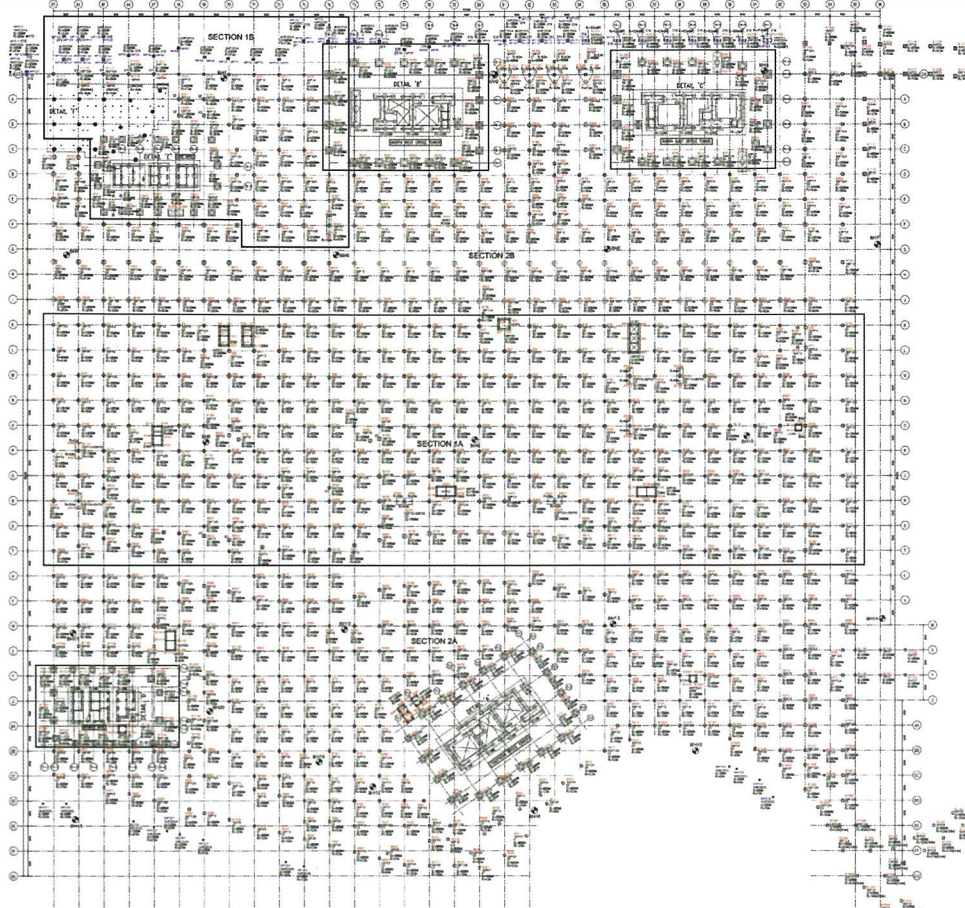


Figure 2: Alternative Piling Layout

Construction Challenge

Total of 1214 nos of bored pile are casted at IOI CITY MALL2. This is the most VO (Variation Order) project that is handled by our company. A lot of challenges we faced and we will show you how we overcome all the difficulties.

The first challenge that we met was the proposed bored pile on ramp, located at edge of slope. The guniting work and soil nail work were completed earlier than our commencement of work. We proposed on the conversion of micropile based on the site condition as per **Figure 6**.



Figure 3: Ramp area at slope site

From **Figure 3**, engineer Khairul (witnessed by our SCM, Danny Ng) was holding the peg which was inaccessible to our bored pile machine. **Figure 4** below was proposed by our Ms. Shairah on the conversion of bored pile to micropile, MP215 and MP216.

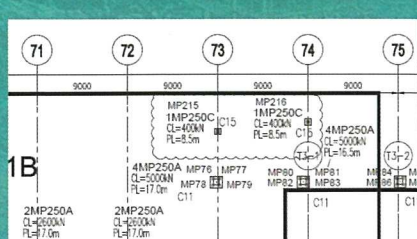


Figure 4: Conversion of Bored Pile to Micropile

Apart from the conversion of pile, we encountered the productivity problem of having one (1) pile per machine per day. This translate into 4 years completion time for 1214 nos. of piles.

Our MD came out with the plan of using long progressive rock auger (at the height of 2.2m) and invested in buying a new auger, we successfully completed 1214 nos of bored pile on at least two (2) to five (5) nos of piles per day after the purchase of accessories, as shown in **Figure 5**.

He (Our MD) remakes our company into significantly better competitors by increasing our productivity. He practically makes fundamental changes in how business is conducted in order to help compete with new, and more challenging market environment.

The blue legend in **Figure 6** shows the difficult soil nail part which has been done using our G-Klemn (clouded area). Previously, the soil nail job scope was being carried out by another contractor using 'leader' method. However, due to loss sandy soil condition behind the slope, the soil nail collapsed before grouting. Thus, we introduced G-Klemn method to help finish up the difficult soil



Figure 5: New Rock Auger

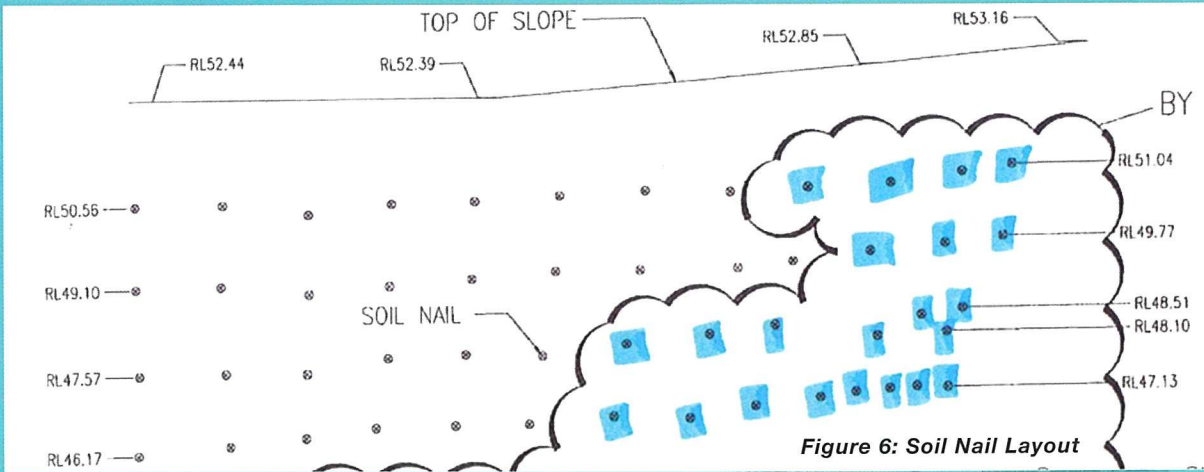


Figure 6: Soil Nail Layout



Figure 7: Soil Nail Works

nail area as highlighted in **Figure 6**. G-Klemn is equipped with drill masts which consists of more powerful operating pressure exceeding 350 bar compared with 'leader' type of soil nail machine. 'Leader' is more convenient on shifting from hole to hole using workers on GI pipe staging. However, to counter the difficult ground condition, G-Klemn is preferred in this case.

On top of that, our G-Klemn hit the RE wall at 6m, which we had relay the soil nail arrangements. Hence, without affecting the stability of slope, we able to drill and grout at 12m. **Figure 6** is the proposed new layout based on existing structure behind the guniting wall.

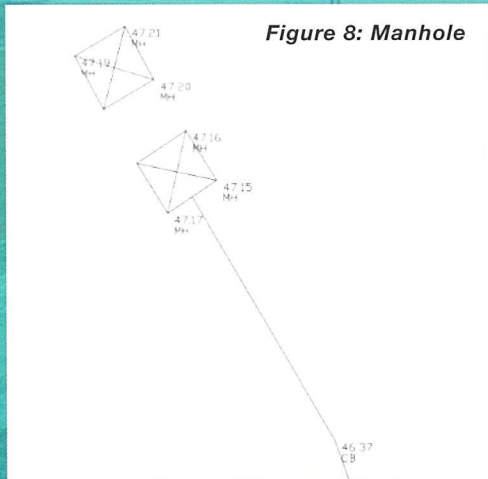


Figure 8: Manhole

Aside from the above challenges, on trumpet road area as shown in **Figure 9**, client suspects pipeline and underground services are located on the pile point. We took our initiative to dig trenches for detection purpose. The risk is high as our excavator will not able to warn us whether it hit pipeline or cable. Hence, on site we hand dug the trench with careful mono boom movement straight up and down, supervised by SHO Nawi.



Figure 9: Existing Pipeline

Besides that, Main Contractor was awarded prior to our completion of Southern area, before the CNY 2019. Finally, we able to complete the whole business hotel area (**Figure 10**) within targeted weeks. The supervisory team including

the client has fully supported on the operation by providing COW team during the CNY long break. We would like to take this opportunity to express our gratitude to SGM of Mayang, PM & Consultants team for their efforts contributed to this project team.

Last but not least, I wish to take this opportunity to thank you, for MD Mr. Lee idea on the 2.5m auger, ED Ir. Oh on proposed spreadsheet, En. Amir on chairing the weekly meeting, Danny Ng on VO work at micropile area, Ms. Alia on all paper submission, Ms. Shairah on proposing conversion from bored pile to micropile and hard work during these months.

Significantly, at the very historical moment of hitting **265 nos of piles per month** (September 2018), the transformation effort of the best chance of succeeding had been proven. This was clearly another acknowledgement of superior performance under the leadership of Project Director, IR. Oh CW.



Figure 10: Business Hotel

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