High-accuracy Piling System used in Construction of Aarah Resort, Maldives

Piling site

CHALLENGE

- Challenge 1 - environmental constraints (marine piling), the markers could move easily and become lost

- Challenge 2 - need for pre-work and high-intensity work

- Challenge 3 - high labour costs, low work efficiency

CUSTOMER

LANKA FOUNDATION AND PILING SERVICES PVT LTD.Customer official

DATE

Project start from 10/2/2017 to present

LOCATION

Maleira island, south of the Vatu atoll, Maldives

Fig 1. The project site.

PROJECT SUMMARY

Instruments:

1x T300 GNSS receiver

1x Piling system tablet (built-in high-accuracy OEM board)

2x AT330 GNSS antennas

Software

Pile Master

Survey Master

Other

Power supply, tripod and related accessories

BENEFITS

- Better project quality: With the ComNav high-accuracy GNSS engine inside, the piling accuracy was improved to 1-2cm.
- Time savings: No pre-operation was required, which substantially increased the piling efficiency, shortened the construction period, and reduced the labour requirements and construction costs.
- Easy to use: The large-screen (9-inch) high-resolution interface is legible at a glance, offers clear voice navigation is intuitive and easy to understand, allowing for smooth operation even by non-professionals.

Fig. 2: Construction steps in the Aarah Resort project.

The three photos (Figure 2) show the piling, construction and completed phases of the Aarah Resort project. In this large piling project, the aim is to build 64 luxury water villas and 12 beach buildings including a restaurant, bar and spa centre, sports club, children's club, etc. The project design is based on construction in a shallow-water area with more than 1,200 mini-piles of 300mm in diameter and 6m or 9m in length, while the maximum depth is 3m underground. The high-precision

piling system of SinoGNSS provides excellent support service. Because the Aarah Resort is located in the neritic zone, the traditional piling approach would require a large number of surveyors to stake out the location under water in advance. This would not only entail high-intensity work, but would also create a real-time problem: even if the coordinates were measured by lofting very accurately, the primary coordinate markers would soon be out of position due to the movement of the piling machines. This shortcoming would be intensified by strong waves, ocean currents and coral reefs which would further reduce the stakeout accuracy. Furthermore, in the subsequent piling process, the piling accuracy would be reduced due to artificial aiming. During the whole process, surveyors would need to work in the water and fix the piles at short range, which would also create huge potential safety hazards. For all of the above reasons, the traditional piling approach would be a low-efficiency, high-cost and high-risk operation.

When, LANKA FOUNDATION AND PILING SERVICES PVT LTD was awarded the project, the company was keen to find an efficient way of tackling the challenges. Looking for the best quality piling solution in China, LANKA contacted the piling machine manufacturer XCMG (-www.xcmg.com/en-eu/) chose ComNav Technology as the system provider due to its strong brand and proven experience.

Compared with the traditional piling method, the SinoGNSS intelligent control system for piling is an all-weather, high-accuracy solution with the additional advantages of being widely compatible and easy to manage. Through software system control and real-time processing and display, it can greatly reduce the number of surveyors on site and the labour intensity of their work. The system can provide customers with practical solutions in terms of real-time guidance to the location, shorten the construction period, save construction costs and enable intelligent visualisation and monitoring to ensure high-accuracy construction work.

System design and setup

The system setup comprised a T300 GNSS receiver as base station and an Android industrial-grade piling system tablet as rover, Pile Master software and two sets of AT330 antennas with 30 metres of antenna cable.

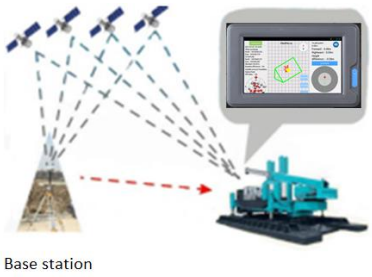

Fig. 3:. Composition diagram of the high-accuracy intelligent manual guidance system for piling.

Operating procedure

• Preliminary data preparation:

The control point data was obtained from the project department plus the CAD design drawing of the piling area or the coordinates of the piling location, and the piling point data was imported into the software.

• Set up base station:

T300 was set up as base station.

Fig. 4: .Fixing the base on the first pile with known coordinate.

The SinoGNSS T300 GNSS

receiver is a high-accuracy RTK receiver, which has internal UHF Tx/Rx and 4G internet. It is also rugged, water proof and dust proof in line with the IP67 standard, making it ideal for field survey and mapping. With the T300 set as base station in UHF mode, the 2 Watt internal UHF transmission enabled the work distance to reach 5km, making it convenient for this project.

• System installation:

Two antennas were installed on the hammer seat, the piling tablet was installed in the driving cab, and antenna cables were laid following the pile-driver routing.

Fig. 5: System installation

• Machine operation:

Surveyors followed the guiding interface and voice to drive to the designated location for piling operation (all done by Pile Master software).

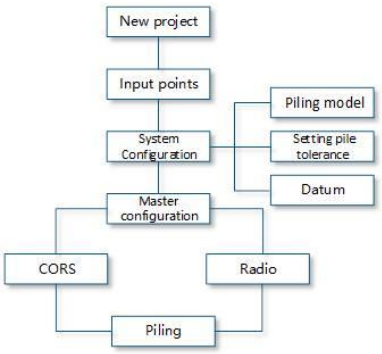

Fig. 6: Operating procedure

1. Coordinates system and input points.

The project was built and the coordinate system parameters keyed in, then designed pile coordinates. In this project the DWG file was imported directly into Pile Master for ease of viewing.

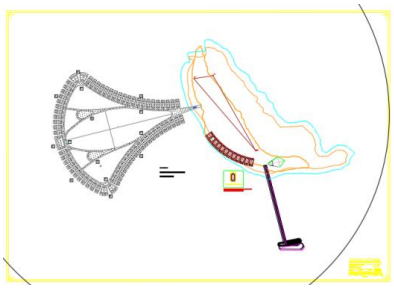

Fig. 7: DWG file data.

2. Calculate the core coordinates of the pile

The three points (two GNSS antennas and one core of pile) were in the fixed triangle.

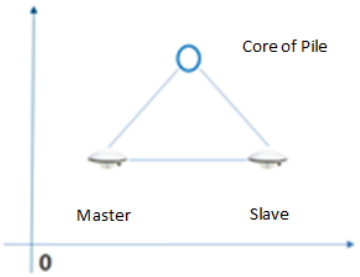

Fig. 8: Calculation principle.

The two GNSS points were obtained by RTK and then used to easily compute the pile points.

Fig. 9: Pile Master built the triangle module.

Pile Master software calculated and transformed the collected parameters to obtain accurate 3D coordinates and the driving parameters of the pile.

3. Piling-friendly user interface of Pile Master

On the one hand, this external output and input unit of the pile driving system forms the basis of the user interface (UI) display, providing piling location guiding information with real-time updates of the calculation parameters. On the other, it facilitates user-friendly interaction with the computer, making it easy to input various parameters of each system.

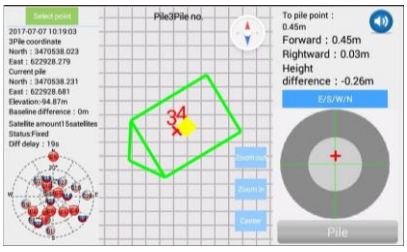

Fig. 10: User-friendly interface of Pile Master.

Conclusion

As the first overseas project following the launch of the piling Solution, this project was highly praised by customers. The traditional piling approach entails low-efficiency, time-consuming and labour-intensive work. At the same time, the work site also has a certain degree of danger. ComNav Technology introduces a new high-accuracy and high-efficiency piling solution. Compared with the traditional piling approach, this project required almost no pre-work and suffered no coordinate offset problems due to no pre-lofting. In this respect, the approach has truly helped to achieve real-time, high-precision and efficient piling.

ComNav Technology Ltd.

Building 2, No.618, Chengliu Middle Rd.

Shanghai, 201801, China

Tel: +86-21-64056796

www.comnavtech.com