



Client

Fugro Netherlands Marine BV



Location

Seme, Republic of Benin



Period

March 03rd – March 18th 2020

Nearshore borehole drilling and CPTu testing for wharf section of the CNPC Crude Oil Pipeline from Niger to Benin.

Fugro Netherlands Marine BV commissioned Project Management International Limited (PMI) to perform a geotechnical site investigation campaign comprising of boreholes and cone penetration tests (CPTu) at pre-selected test locations. The project was to evaluate the subsurface geotechnical condition and provide relevant geotechnical information required for the foundation design of a wharf protected by a breakwater and connected to shore by an access trestle, positioned near the launch point of the marine pipeline.

Project Site

The project site was located offshore Seme, about 3km to Benin-Nigeria border in Benin and about 30km east from Cotonou.

The Scope of Work

The scope of works comprised of

- 3 no. CPTu tests to 40m target depth
- 4 no. Boreholes to a target depth of 40m below seabed, with standard penetration test (SPT) and undisturbed sampling.

Equipment Used

Jack-Up Barge (JuB) and Support Vessel

PMI deployed the Jack-Up Barge PMI Dragon on which the CPTu equipment and borehole rig were mounted. A support vessel was used to position the Jack-Up Barge, after which the JUB four point anchoring system was used to bring the barge within its target position.

CPTu Equipment

PMI mounted their 200kN push capacity CPTu rig, to execute the CPTu tests. The entire assembly was mounted on the Jack-Up Barge, PMI Dragon.

Borehole Equipment

PMI employed the Fraste Multidrill ML which is designed and equipped to perform a variety of boring techniques. The types of techniques employed – continuous double barrel percussion, continuous hydraulic push, SPT - was dependent on the material type and also in consultation of the client's representative.

Execution

Following methodology was used to execute the CPTu tests:

- Position the JuB to the test location
- Raise and level the JuB platform.
- Install 300mm OD string of steel casing through the JuB moonpool; install smaller 50mm string of bubble casings to guide the CPT rod and avoid buckling.
- Prepare probing rods by feeding data cable through.
- Install saturated filter on CPTu cone
- Set up data acquisition system, install cone, perform initial calibration and commence probing.
- Terminate test at target depth or refusal and move to the next location.

The boreholes we executed using the following methodology:

- Position the JuB to the test location.
- Raise and level the JuB platform

- Install drill casings from JuB platform to seabed, noting the depth from platform to seabed.
- Deploy string of drilling tools and commence drilling using the continuous double barrel percussion technique and switch to rotary technique in very dense formation.
- Perform SPTs and undisturbed Shelby tube sampling at interval, with undisturbed sampling alternating with SPT depth intervals
- Terminate borehole at target depth.
- Relocate and commence borehole at next location.

Results

The CPTu tests produce a graph indicating a continuous measurements of Cone resistance (q_c) and Sleeve friction (f_s).

Representative continuous soil samples, SPT samples and Shelby samples were obtained from the boreholes. All borehole logs were prepared with gINT software.

All test results of this investigation were presented in a factual report produced for the client.

Conclusion

Even though the project was performed entering the challenging offshore adverse weather period along the West African coast, PMI performed the campaign to the entire satisfaction of the Client and without incident.

The in-house experience in the area has proven to be the key to success.