

CAPABILITY SHEET

GEOTECHNICAL INVESTIGATION

INTRODUCTION

Geotechnical soil/site investigations are performed to obtain information on the physical properties of (sub-) soil and/or rock at or around a project site. This information is required to design earthworks and/or foundations for proposed structures or to determine the soil characteristics of materials to be dredged and/or reclaimed.

A geotechnical site investigation will include surface and subsurface exploration of a site. Subsurface exploration usually involves soil sampling and laboratory tests of the soil samples retrieved.

EQUIPMENT

Nigerian Westminster Dredging and Marine Ltd. (NWDM) in technical partnership with Boskalis Environmental (BKE) has the following equipment in-house available for geotechnical site investigations:

- CPT (Cone Penetration Test) Rig;
- Vibrocorer;
- Drilling Rig (Pilcon)
- (Mobile) Laboratory

CPT

A Cone Penetration Test (CPT) is performed using an instrumented probe with a conical tip, pushed into the soil hydraulically at a constant rate. A basic CPT instrument reports tip resistance and shear resistance along the cylindrical barrel. CPT data has been correlated to soil properties.



A CPT unit can be mounted on various carriers depending on the project-specific site conditions. For the Brass LNG Early Works project (2007 - 2010) NWDM mounted the CPT unit on the undercarriage of an old crawler crane. On this project the CPT unit was also used to install the settlement monitoring equipment such as piezometers and extensometers.

More recently this CPT unit was used for an extensive site investigation at the Onne Port Expansion project (2011 - 2012).

VIBROCORER

A vibrocorer is a relatively compact unit that can be used for the collection of aquatic sediment cores in water depths of up to 50 m. It can obtain sediment cores of typically 4 to 6 m long and 3 inches (76 mm) in diameter from unconsolidated sediments.

It is the ideal tool for taking sediment cores for contaminant or granulometric analyses in ports, harbours, estuarine and freshwater environments in support of dredging operations, coastal development and cable/pipeline routing projects. It can be deployed from relatively small vessels.

After the unit has been positioned on the sea/river bed, an electric vibrating head forces a tube with a liner into the subsurface. Further advancement will occur for the length of the core tube or until dry, compacted, or consolidated material is reached.

Hereafter the unit is lifted back on board and the liner is removed from the tube and opened. Samples can be taken from the liner and/or soil descriptions can be made.



In 2012 NWDM/BKE carried out an extensive sand search in the Bonny River for the Onne Port Expansion project. On this occasion the vibrocorer was deployed from the Boskalis multi purpose vessel BKM 100.

- A** CPT Unit
- B** Vibrocorer

DRILLING RIG

A Pilcon Rig is used for shell and auger drilling. By repeatedly surging the shell up and down at the base of the hole, soil can be collected and removed from the hole.

It is possible to take disturbed and undisturbed samples for further laboratory investigations. At the same time various in-situ tests can be carried out such as Standard Penetration Tests (SPT's). The Pilcon Rig can also be used to install inclinometers, etc. for geotechnical monitoring of soils.

A Pilcon Rig can be used both on land and over water. For this last option NWDM converted an existing pontoon into a dedicated drilling barge. With this unit extensive sand searches have since been carried out at various locations in the Niger Delta and the Lagos and Lekki Lagoons.

GEOTECHNICAL ANALYSIS

Samples taken during a drilling campaign are analysed in Nigeria or The Netherlands, dependent on the type of analysis. Coordination of these analyses is performed by NWDM and BKE.

In Warri, Nigeria, a laboratory is available for basic geotechnical analyses of the soil samples. Furthermore mobile laboratories are available for use on specific project sites.



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If analysis on undisturbed samples are necessary, samples are shipped to The Netherlands to the BKE lab. A permit for import of these samples is available. In the Netherlands, oedometer and triaxial tests can be performed.

REPORTING

NWDM in collaboration with BKE reports all results of the geotechnical soil investigation. If engineering is necessary, Hydronomic BV (Head Office of Boskalis) can be consulted.

- C** Pilcon Rig at Onne Port
- D** NWDM Drilling Barge
- E** Warri Laboratory
- F** Site Laboratory at Onne Port

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