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Case Study : Pile Engineering

G-Octopus and Cathie perform pile engineering near a pitch lake at Brighton Port, Trinidad

The project

Brighton Port is located in La Brea in the southwest of Trinidad. The site was undergoing several renovations, including that of the 355m Berth line and 60m cofferdam junction with Berth 1. The combined expertise of Cathie and G-Octopus was brought on board by Soletanche Bachy Cimas S.A. to perform the pile engineering required for the repair of the quay retaining structure and a heavy lift area of Berth 2.

Our challenge

G-Octopus was initially engaged by Soletanche Bachy to provide a quotation for Pile Driving Monitoring services on open ended steel pipe piles (used in the Heavy Lift area) and H piles king size (used in the quay wall) for a project identified as a standard port and harbour project, with the aim to validate piles capacity. However, due to the complex geology of the area the client requested G-Octopus to provide a detailed study to foresee the elevation of piles tips and the expected bearing capacity due to the Pitch Lake located nearby which contained a huge natural deposit of bitumen and could be problematic to the project for the pile driving.

The solution

Realising the benefit of Cathie Group's combined expertise, G-Octopus and Cathie were brought on board. Cathie reinterpreted the data and borehole logs of the available geotechnical site investigation and, as one of its specialties, built the "ground model".

The pitch lake incorporates layers of "pitch" (bituminous asphalt material) with clays and sands and meant that pile capacity would be difficult to attain due to the long-term creep behaviour of the bitumen. As there was only a finite length of piles available on site, the results needed to be accurate. At the same time, the pitch layers were a potential harm to driveability due to the dynamic behaviour of the pitch, which is highly viscous and hard when subjected to dynamic impulses.

The results of the investigation and soil profile were quickly shared with the Soletanche-Bachy and G-Octopus team to allow them to start their driveability analysis. They used OPILE, Cathie Group's in-house software, to compute soil resistance to driving (SRD) and carried out calculations of blowcount and pile dynamic stress during driving with GRLWEAP software.

Then, in order to highlight the possibility of early refusal during the installation, the team carried out driveability analyses on both types of pile and used that analysis to determine how the piles would be driven to the target depth, required to grant the ultimate axial capacity. In addition, the axial capacity was optimised by the project team in order to find the best solution by taking into account the feasibility of installation by driving to required depth, reduction of the required pile length considering soil set-up, and optimisation of the distribution of pile length across the area (depending on local soil profile), to stay within the amount of available material on site.

The impact

We were able to understand and anticipate the issues that could occur during construction and propose a pile monitoring and acceptance procedure which allowed construction activities to progress without major time loss and without requiring longer piles. In addition, by engaging Cathie Group as a whole, we were able to save the client valuable time through our "One Team" approach which meant that sharing data, information and expertise could be carried out seamlessly.

Services included:
- Geotechnical data interpretation and realisation of the Ground Model
- Calculation of the ultimate axial capacity for zones, identified by the Ground Model
- Driveability analyses
- SafeTip services
- Establishment of pile acceptance criteria.

Pile information:

Open ended piles
- Diameter: 1219 mm
- Thickness: 15.5 mm
- Length: variable from 30 to 40m

H Piles
- Dimension: HZ 1080 (1080mm)
- Thickness: 16 mm
- Length: 30m

Equipment used:
- GRLWEAP software
- OPILE software.

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