

A hybrid approach

Using a system combining elements of heave-compensated drills and construction support vessels, Fugro is setting a new bar in vessel-based offshore drilling

Fugro's derrick-to-vessel installation on the DP2, multipurpose construction vessel Southern Ocean

Fugro brought together its marine construction support capability and offshore drilling expertise to create a heave-compensated XL-drilling solution. A team of experts from several Fugro offices in Europe and Asia developed this hybrid approach as part of a project to install subsea moorings at an energy site in the southern hemisphere.

Using the DP2 (dynamic positioning system), multipurpose construction vessel Southern Ocean as the base platform, the project team created a drilling system using reverse-circulation drilling that could withstand the effects of swell and vessel heave.

Fifteen piles were installed using open-hole drilling and grouting, and a further nine via drive-drill-drive techniques in which a pile is hammered to refusal and then relief drilled before hammering to depth.

Working in water depths of up to 120m, the system successfully installed piles up to 28m long and 3.2m in diameter in what is thought to be a world-first in heave-compensated drilling from an offshore construction vessel.

As well as marking a technical first, Fugro says the design enabled the site team to achieve a high rate of productivity. Drilling of all 24 piles was completed within six weeks, which is half the expected programme time.

CHALLENGING CONDITIONS

Ground conditions were generally characterised as a thin layer of sand over rock, with up to 12m of overburden in places. The variability of ground conditions required more than one drilling and pile installation technique.

Open-hole drilling and grouting were performed in most pile



locations, given the potential for the terrain to produce significant uplift on the piles.

Casings were used to shore-up unconsolidated material in locations with 2-3m of overburden. Where sand layers exceeded 3m in depth, Fugro deployed a drive-drill-drive method, using a pile guide frame with grippers. This was designed to keep the pile upright, control its descent and keep it stationary when under-reaming was performed.

At the heart of the solution was a robust drilling tower (derrick) positioned over the vessel moon pool. Measuring 32m high by 16m wide and 15m deep, the derrick housed a carriage-mounted hydraulic power swivel, from which the drill string and bottom-hole assembly (BHA) were suspended. Vertical motion and heave compensation were provided by the vessel's crane.

Two bespoke drill bits were provided (with under-reaming capability) to drill sockets from 1.96-2.32m in diameter. This set-up incorporated vertical travel of up to 24m in a single stroke, enabling the drilling of 18m deep sockets while allowing for the effects of heave and tide.

Brian Bell, Fugro service line manager for marine geotechnical Europe, says: "Despite the technical and logistical challenges

of teams contributing from different parts of the world, everyone involved collaborated seamlessly to meet the project's objectives."

MULTIPURPOSE

According to Fugro, the approach provides a cost-effective means of fixing seabed foundation frames capable of anchoring vessels or equipment in challenging conditions, such as Pacific typhoons.

The company says it has many potential uses, including in the marine renewables sector for the installation of anchor piles for floating wave devices or wind turbines, and fixing seabed foundation frames for wave and tidal generators. The method could also be used for the deep-water installation of jacket foundations and anchor piles, as well as for monopiles of smaller diameters (dependent on ground conditions).

Les Lugg, Fugro nearshore director, says: "Based on our proven track record of developing innovative engineering solutions, we can reduce and manage the risks involved in complex construction challenges in all kinds of marine environments. We provide clients with a safe, effective and predictable supply chain partner for their projects." ▼



The derrick housed a carriage-mounted hydraulic power swivel to rotate the drill string and BHA