BARGE MASTER

LIMETREE PROJECT
MOTION COMPENSATED DRILLING

MOTION COMPENSATION PLATFORM ENABLES OFFSHORE DRILLING FROM VESSEL

Large Diameter Drilling (LDD) and Barge Master have combined their expertise to complete a world's first: drilling operations from a diving support and construction vessel (DSCV) in water depths in excess of 270 m. By integrating LDD's reverse circulation LD2500 drill rig with Barge Master's motion compensation platform (BM-T700), they have successfully completed the installation of seven anchor mooring piles for a catenary anchor leg mooring (CALM) buoy. The unique technique employed has potential for industry-wide application.

The project was executed in the Caribbean Sea, off the coast of St. Croix, part of the U.S. Virgin Islands, for Imodco Services, a subsidiary of SBM Offshore. The Limetree Bay refinery needed a new CALM buoy installed, which is used as an offshore loading terminal. A CALM buoy consists of a floating buoy anchored to the seabed by catenary chain legs, which are secured to anchors or piles. This allows for the system to move freely so that a tanker can take up the position of least resistance to the prevailing weather.

In this case, the CALM buoy is connected by a submarine pipeline to the onshore production refinery. The CALM Buoy needed seven anchor piles drilled, in water depths ranging from 80 to 270 m.

Alternative Method

Conventionally, this sort of drilling would be done using a jack-up barge (JUB), or from the pile top itself, but this project had particular challenges. One was the large water depths ranging up to 270 m, combined with a sloped seabed of up to 17°. Another was the seabed conditions, consisting of sand at the shallower locations and limestone at the deeper locations. Additionally, the physical attributes of the anchor pile design made sure that typical methods were impossible.

Therefore, an alternative, floating method needed to be found. The swell at the location is strong, so a normal drilling vessel would be unreliable because it would need to wait for optimal weather. To address the location's challenges, LDD and Barge Master teamed up to provide a solution using Barge Master's motion-compensated platform (BM-T700) with LLD's reverse circulation drill rig (LD2500).

Barge Master had already executed a floating drilling operation for the Wikinger wind farm installation in the North Sea off the coast of Germany. The project proved that the motion-compensated platform was suited to keep high-precision equipment stable for the job, with operations lasting over 27 hr.

The motion-compensated platform has the capacity to stabilize 700 tons of equipment or cargo at up to Hs 2.5 m (significant wave height). It compensates the heave, pitch and roll motions, relying on the vessel to hold position in the horizontal plane. The system is completely containerized and can be mobilized easily on any barge or vessel to serve as a stable working base. The motion-compensated platform has been used for many different applications, ranging from lifting operations with a normal land-based crane on top to feedering solutions.

The LD2500 from LDD, a company with over 30 years of experience in difficult nearshore and offshore projects, is a reverse circulation drilling rig, capable of drilling through almost any soil and rock type. The rig can accommodate standard LDD drill bits up to 2,500 mm, with under-reaming options allowing the drilling of much larger holes. The LD2500 has up to 539 kNm of torque.

Together, the motion-compensated platform with the drill rig on top made the perfect solution for the challenging project. The equipment was mobilized on SBM Offshore's diving support and construction vessel SBM installer. The mobilization took place in Rotterdam in early 2019, and then the equipment was partly demobilized again for the sail out to St. Croix, where the final setup was mobilized.

Drilling System

For the project, seven anchor piles needed to be drilled, ranging from 80 to 270 m. During the drilling operations, the compensation mode of the motion-compensated platform remained active. The LDD2500 drill rig has a drill string of 3 m; thus, at every 3 m of drilling, a new drill string had to be attached. When a new drill string had to be attached during the drilling operations, while maintaining

active compensation mode, the motion-compensated platform was moved 500 mm upward in order to provide clearance between the seabed and the bottom hole assembly. Once the new drill string was added, the motion-compensated platform moved back to its mid-stroke.

The drilling system is self-sufficient; it is able to feed pipe without the vessel's crane. The setup included a full grouting spread deployed from the rear of the vessel. During the project, the drill system used a variable diameter drill bit and fully shrouded stabilizer. The sockets for the anchor piles were drilled to a diameter of 2.3 m and a depth of 20 m.

Conclusion

The project was successfully completed in the second quarter of 2019. Offshore drilling workability increasing from 13 percent without motion compensation to 90 percent with the motion-compensated platform. There were zero safety incidents during the project and an uptime of over 90 percent.

The combined systems operated for over 24 hr. straight, without any loss in performance, in sea states up to Hs 2.5 m. The process of drilling, anchor pile installation and grouting took approximately one week per pile.
The completion of this project demonstrates that large-diameter drilling can be achieved from a floating asset with motion compensation.

This is the second motion-compensated drilling project, but the first at large water depths. The two successful projects, combined with the track record of other projects with the motion-compensated platform, prove that this solution is ready for market-wide implementation. It provides an alternative for jack-up barges and a solution for large water depths. This can be beneficial for the installation works of all offshore markets, from renewables to oil and gas, as well as the civil sector. In addition, this setup can be used for floating motion-compensated rigless well intervention or coiled tubing.

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