In the middle of the Po delta

Ipogeo used a Comacchio MC 15 drilling rig for the re-profiling of a quay of the Visentini Shipyard

The past months have been particularly challenging for the passenger ship companies in Italy. However, the Italian shipbuilding industry looks confidently at the possible allocation of public resources for the renewal of the fleet intended for passenger and cargo transport within the framework of the National Recovery and Resilience Plan, with interesting prospects for the construction of new ferries in Italy.

SHIPYARD VISENTINI

Among the major national players, the shipyard Cantiere Navale Visentini carries on the construction of large ro-ro and ro-pax vessels that enjoy recognition of shipping companies operating both nationally and internationally, from the Mediterranean Sea to Northern Europe. The family-run company, headquartered in Porto Viro, in the province of Rovigo, is situated on the right bank of the river Po di Levante, in the Po Delta wetlands.

The whole production site, extending for about 250,000 square meters, is located along the river, which allows the vessels to be launched into the Adriatic Sea. The peculiar morphology of the Po Delta is that of a depressed land lying up to 3 m below sea level, where drainage canals and water pumping stations allow for the reclamation of the low-lying territory and are fundamental to keep land and infrastructures dry and maintain effective soil depth for agriculture practices. Given the

morphology of this low-lying delta and coastal area, the river flow is contained by embankments on both sides.With more than 230 ships built since its foundation in 1964, Cantiere Navale Visentini specializes in the construction of large ferries for shipping companies such as Grandi Navi Veloci and Grimaldi Lines. The company has recently started an extensive upgrade on part of the docking facilities located inside the shipyard, within the river embankment. The aim is to improve operations during vessel construction, as the vessels are moored in the river during assembling and outfitting. The project was entrusted to Costruzioni Generali Xodo Srl, also based in Porto Viro, a contractor specialized in hydraulic engineering and foundation construction, dredging, earthmoving, infrastructural and road works, with numerous projects carried out in the river Po basin. When the project will be completed, the existing work area of the shipyard will be enlarged towards the river side by 1490 square meters. To achieve this, a new quay wall will be built with the use of Larssen sheet piles driven into the riverbed, supported by a reinforced concrete quay beam with an anchor system to hold the top of the wall. Correct design of the tieback elements forming the anchor system is vital for the stability of the structure.

THE SPECIALIZED JOB

This highly specialized part of the job was awarded by Costruzioni Generali Xodo to company IPOGEO Srl, based in Seren del Grappa, in the province of Belluno: a deep foundation contractor that has been providing services to the industry for twenty years, with a particular focus on difficult access and logistically challenging projects.

The family-run company operates under the leadership of Mr. Graziano Miglioranza, who has been joined in recent years by his daughter Elisa. (See box) Elisa and the site manager Mr. Franco Zuglian of IPOGEO Srl describe how the project was successfully delivered in record time. "The contract entrusted to Costruzioni Generali Xodo Srl involves an upgrade of the existing quay section for a total length of approximately 170 m", explains Elisa Miglioranza, Technical Director of IPOGEO Srl, "After a first phase where the construction site inside the Visentini property was prepared and the logistics was set up, the contractor immediately started with the installation of the 16 m long sheet piles that were driven into the riverbed along the existing quay wall. Subsequently, the space between the new sheet piling and the existing quay wall was filled with material up to 2.50 m below design dimension ".
Once the sheet piles were driven into place, the contractor could proceed with the installation of temporary tiebacks, with a spacing of 3 m, that were prestressed with an initial tension of 7 tons. These tiebacks acted on a waling beam placed on the sheet pile side, consisting of two U-profiles attached to the existing quay to transfer the loads.
After the temporary tiebacks were installed, filling material was added up to the top of the sheet piles, and the temporary formwork was fixed on the water side, while the tension of the temporary tiebacks was increased up to 9 tons. "The final edge beam was built in reinforced concrete and

Who is Ipogeo

Ipogeo is a specialist drilling contractor led by Mr. Graziano Miglioranza and his daughter Elisa as a technical director. The company focuses on geotechnical construction projects involving deep foundation, ground improvement, earth retention systems and site investigations. Due this highly specialized capabilities, Ipogeo S.r.l. has an excellent record in the execution for a large number of projects for both governmental and private organisations, many of which are located in the port area of Venice and Trieste. Led by the Miglioranza family, the team includes two site managers and 7 crews of highly qualified drillers, supported on every single aspect by a well-established group of technicians (engineers, geologists, architects, laboratory personnel, computer experts). Ipogeo has extensive experience in the design and execution of foundations construction for residential and commercial buildings. The company has the capabilities to carry out directly all site investigation activities (with external authorized laboratory certification), draw up geological and geotechnical reports with the added value of a specialization that allows to ensure the most suitable and cost-effective technical solution for the client's needs. The services offered by Ipogeo S.r.l. also include design development in support of foundation engineering firms.

Comacchio **MC 15**

The MC 15 is a compact, high-performance versatile drilling rig that can be used on many types of construction drilling applications: micro-pile, soil nailing, anchors, jet grouting, foundations and ground consolidation in general. A major feature of the MC 15 is the variety of mast positions and inclinations that it can perform; thanks to its patented mast articulation system, this drill rig can be used in confined or low headroom spaces. Equipped with advanced modular hydraulic circuits, the MC 15 can accommodate a wide range of rotary heads and accessories, including hydraulic drifters, double head systems, water and mud pumps, winches and rod carousels. The MC 15 can be equipped with hydraulic proportional servo-assisted controls or remote radio control. Like all Comacchio rigs, the MC 15 can be customized to meet your specific needs.

the filling of the yard on the back was completed", continues Elisa Miglioranza, "After that our crew was able to begin with the installation of the permanent tiebacks".

COMACCHIO MC 15

The project involved the installation of 55 permanent 35 m long tiebacks (with 10 m unbonded length) consisting of seven spring steel strands, with a spacing of 3 m and an inclination of 30 °. "We decided to perform the drilling using 114 m rods and 170 mm diameter casings", explains site manager Franco Zuglian. "Drilling operations were performed from a floating pontoon equipped with the Comacchio MC 15 drilling rig, a service excavator that was used to facilitate the insertion of the tiebacks and the positioning of the pontoon, and a triplex pump that supplied the water used for flushing. The soil in this area is formed by fluvial delta deposits, consisting mainly of silt and soft silty clays.
We therefore chose to carry out the drilling using casings and water flushing". To facilitate tiebacks installation, guiding pipes with an internal diameter of 200 mm were fixed through the sheet piles. As soon as drilling to design depth was completed, the tiebacks were put into place while the primary mix was injected into the annular space between the borehole and the strands. After that, three casings were withdrawn at a time and the injection was resumed until the recovering of the casings was completed.
"After 4-5 hours it was possible to proceed with the final grout injection through the sleeved grouting pipe, reaching the pressure needed to grant a perfect cementation of the anchors in the bond length. ", explains Mr. Zuglian. "We had a hydraulic injection plant and a turbo mixer on site to prepare the grout mix. The second phase injection was carried out using a double parker with caps. After curing, the tiebacks were tensioned as per UNI EN 1537/2002 standards and sealed ".

THE WINNING CHOICE

The major difficulties resulted from the need to operate in a very particular fluvial environment, located in the centre of the Po Delta. "The changes of the water level caused by the alternation of high and low tide forced the operator of the drilling rig to continuous re-positioning on the borehole to maintain the alignment with the centering tubes that were placed at the end of the sheet piles. In addition to that, we found it hard to drill through the existing quay wall that is built of structural diaphragms with iron reinforcement. The MC 15 proved to be the winning choice, because it combines compact dimensions and low weight, essential to be able to work from a floating pontoon, with high rotary torque, but above all it is equipped with an articulation system that allows you to reach a large variety of mast positions and inclinations in a simple and precise way ". "The day set for the beginning of tiebacks installation was June 1", recalls Elisa Miglioranza, "while the deadline for completing the job was set for July 15. Due to the preparation of the jobsite, we were able to start drilling the first tiebacks on June 4 and completed the project on the first of July. We worked for two weeks with a double shift per 24 hours, reaching a production of 4 tiebacks a day. We are always looking for new challenges! ". The project was delivered on July 29, with all tests on the anchors passed successfully.