Water gallery at Dunkirk LNG terminal

Underground structures

Feb. 2014 - Sep. 2015

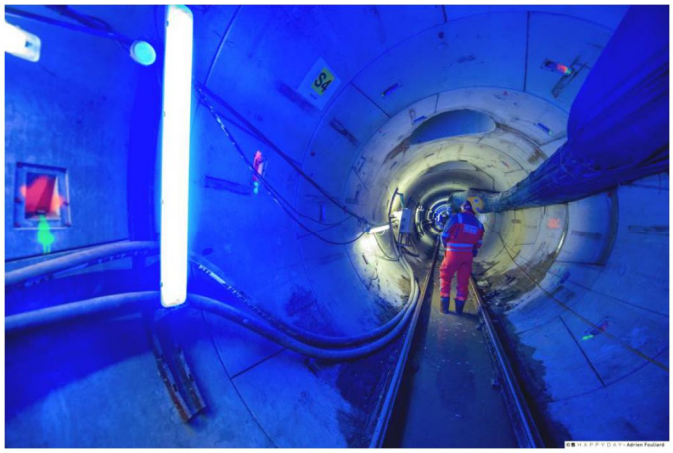
FRANCE - Dunkirk

Client

COFIVA (EDF)

Project owner
Dunkerque LNG

Miscellaneous
Hydraulic gallery 5000 m long,
Diameter: 3,8 m



Description of the project

As part of the Dunkirk LNG terminal works, TERRASOL first designed the foundations of the three 190 000 m^3 capacity LNG tanks for the group ENTREPOSE PROJETS - BOUYGUES TP. TERRASOL was then entrusted with the design and monitoring of the hydraulic gallery excavation, executed by consortium BRS (CSM BESSAC – RAZEL-BEC – SOLÉTANCHEBACHY), and which is intended to recover 5 to 10 % from the warm waters of the Gravelines nuclear power plant to heat the liquefied gas. The gallery access shaft, 16 m in diameter and 50 m deep, was excavated inside a diaphragm wall (65 m deep). The tunnel, 5 km long and 3.8 m in exterior diameter (3 m in interior diameter), was excavated with an earth pressure balance (EPB) tunnel boring machine (TBM). Its complete alignment is located in the Flanders clays, a very homogeneous over-consolidated layer. Progress was satisfactory until the TBM suffered damage on April 29, 2014, when it was still under the outer harbour. The problem was a failure in the link (dowels) between the gear box and the TBM cutting wheel, making it impossible to continue excavating without repair. Moreover, the repair works had to be done from the front of the TBM. The consortium chose to proceed by excavating a bypass tunnel about 25 metres long using conventional method, starting from the back of the TBM skirt and joining the front part, with creation of a disassembly chamber ahead of the cutting wheel.

Key features

- Follow-up of tunnel excavation works under the harbour and the Gravelines plant, supervision of works for the bypass tunnel and the disassembly chamber, supervision of works for the connection of the release basins)

Description of the mission

TERRASOL was in charge of the supervision of geotechnical works for the bypass tunnel on behalf of COFIVA. The contractor worked in an extremely confined space, taking all necessary precautions to ensure the safety of the staff and the feasibility of the repairs. The tunnel and chamber reinforcement techniques used evolved day-by-day according to site conditions.

After a six-month interruption only (part of this delay was made up subsequently), the TBM resumed its excavation, in a sensitive site where the TBM was not allowed to generate surface settlement of more than 1 cm. Before reaching the plant, a backfill section was used to analyse surface settlements over nearly 500 m, in order to validate the TBM parameters as it progressed and to calibrate the 3D excavation model. The pressure at the TBM face was increased progressively from 0 to 3 bars over the test section in order to determine a settlement/ confinement relationship covering a large range of pressures. The analyses showed that our numerical approach was capable of representing the soil response to the tunnel excavation accurately. The settlement development is influenced by the confinement pressure, and the settlement generated behind the face is related mainly to the volume of mortar injected around the skirt. The excavation works were completed by March 2015, and the instrumentation equipment installed by the consortium on the power plant site and monitored jointly by BRS and TERRASOL showed that surface settlements generated by the TBM did not exceed 6 mm.

The last step was to connect the tunnel to the 12 siphons of the release basins of the nuclear power plant. This extremely delicate connection method was defined by the consortium and required special equipment as well as small section earthworks within a confined space 1.3 m in diameter. TERRASOL worked on behalf of COFIVA to validate the connection principles and monitor on-site operations.

The gallery was filled with water in August 2015.

terrasol
Immeuble central seine
42 - 52 quai de la rapee
75583 Paris cedex 12 France
Tél +33 1 82 51 52 00
Fax +33 1 82 51 52 99
info@terrasol.com