28,000 square metres of construction pit for Danske Bank in Copenhagen

Construction pit, piling and extensive groundwater lowering

SOIL & BUILDING A/S

In 2019, Soil & Building A/S entered into a contract for the con- struction of Danske Bank's new headquarters at Bern- stoffsgade in Copenhagen. The contract comprised a 73,000-square-metre headquarters and an additional 40,000 square metres of parking facilities and technical installations. Prior to the building work, a comprehen- sive piece of work had taken place. The reconstruction and demolition of the existing buildings of the former post office area. The reconstruction and demolition work of structures above ground level were carried out by G. Tscherning with Soil & Building A/S management contractor.

A large-scale project

At the beginning of 2019, Soil & Building A/S began to establish the 28,000-square-metre-large construction pit and to demolish basement and old foundations alongside the demolition works. The construction pit is unusual as the area is dominated by hard Copenhagen limestone from 11 metres below ground level. The chosen sheet pile installation method was a pre-bored trench in the dimension DN880 millimetres, which was stabilised with concrete bentonite, and the sheet pile profiles were subsequently installed by vibratory driving. This way hard/impossible driving in limestone would be avoided and vibrations and shock impacts of the sur- rounding buildings and constructions were taken into consideration. Long sheet piles of 15 to 18 metres were installed with a toe level of 2 metres into the limestone to get a sufficient fixation of the wall. After installation of the sheet piles, the construction pit was excavated to a depth of 8-9 metres, and the retaining wall was braced in two levels with a total of 471 strand anchors complete with wailing structures.

Furthermore, for Danske Bank's new headquarters, comprehensive piping works were performed using 2,500 driven concrete piles, 500 uplift anchors, 80 GEWI piles for crane foundations as well as 70 drilled piles in dimensions between DN880-DN1800 millimetres.

What makes this construction pit special is its impressive size. We have excavated, removed and deposited 190,000 cubic metres of soil and 40,000 tons of concrete. In addition to the geotechnical challenges at site, a central and complex challenge was to keep the entire construction pit dry.

Major pipe relocation

An additional challenge at the former post office area was that HOFOR's main sewer from the city areas Frederiksberg and Vesterbro ran through the entire construction plot, so it had to be relocated. In this connection, we increased the dimension from DN1750 to DN2000 millimetres to ensure the same capacity.

Large-scale groundwater lowering

When designing the construction pit, we highly focused on the large-scale groundwater lowering, which was necessary to keep the area dry. Especially, as there was a requir

ment of a 100% reinfiltration of water, which was a challenge to handle in central Copenhagen. That is why we designed a cut-off effect to limit the inflow of water into the limestone deposits in the ground.

The cut-off solution meant that all the pre-drillings for the retaining wall had to be drilled about two metres deeper than the length of the sheet piles in order to cut off the most per- meable layers. By using this method, we only had to handle approx. 150 cubic metres of water per hour instead of more than 1,000 cubic metres of water.

This central part of the project was a matter of "closing" the construction pit, in order to lower the water inside it and avoid lowering the groundwater outside the pit. Around the former post office area, there are several challenges con- nected to the groundwater lowering. For instance, nearby in an old part of the town, several buildings are resting on tim- ber piles, which must not be exposed to air during lowering of the groundwater. On the other side of the railway is the Meatpacking District, which is located above a major source of pollution, from where we should avoid groundwater inf

Data

- Removal of 40,000 tons of existing foundations below ground level
- Relocation of a DN 1,700 mm wastewater pipe to a new pipe of DN 2,000 mm with a temporary bypass pumping over 300 m with a capacity of 2,000 l/sec.
- 190,000 m³ of excavated soil
- 958 pre-drilled holes of DN1180 for sheet pile installations and establishment of cut-off in the limestone, a total of approx. 11,750 lm
- 16,000 m² of sheet piles
- 471 ground anchors in two levels in the retaining walls of the construction pit
- 1,340 lm of waling structure for wall anchors
- 2,500 concrete piles, 30x30 cm and 40x40 cm piles, 7-8 m long
- 500 uplift anchors
- 80 GEWI piles
- 70 drilled piles, DN880, DN1180, DN1500 and DN1800
- 57 pump wells
- 30 monitoring wells and observation wells
- 1,700 pumping pipes
- 72 infiltration wells
- 2 water treatment plants for groundwater lowering
- 2,100 m of reinfiltration pipes
- 1 SCADA-system for control and monitoring of ground- water lowering.

Client
Ejendomsselsk
Project Nord P/S

Type of contract
Design and build contract carried out in a One Company collaboration between Con- struction and Ground Engineer- ing

Consulting engineer
Cowi A/S

Construction period
January 2019-August 2020

Contract value
DKK 350 million

Soil & Building A/S Ground Engineering is one of Europe's piling and dril- leading piling contractors, and we undertake vibrators.

a wide variety of piling, drilling and foundation projects in Denmark and abroad. We have offi- ces in Poland, Sweden, Norway, Germany and the UK.

Our fleet covers fully hydraulic ling rigs as well as cranes and