

# Urban excavation

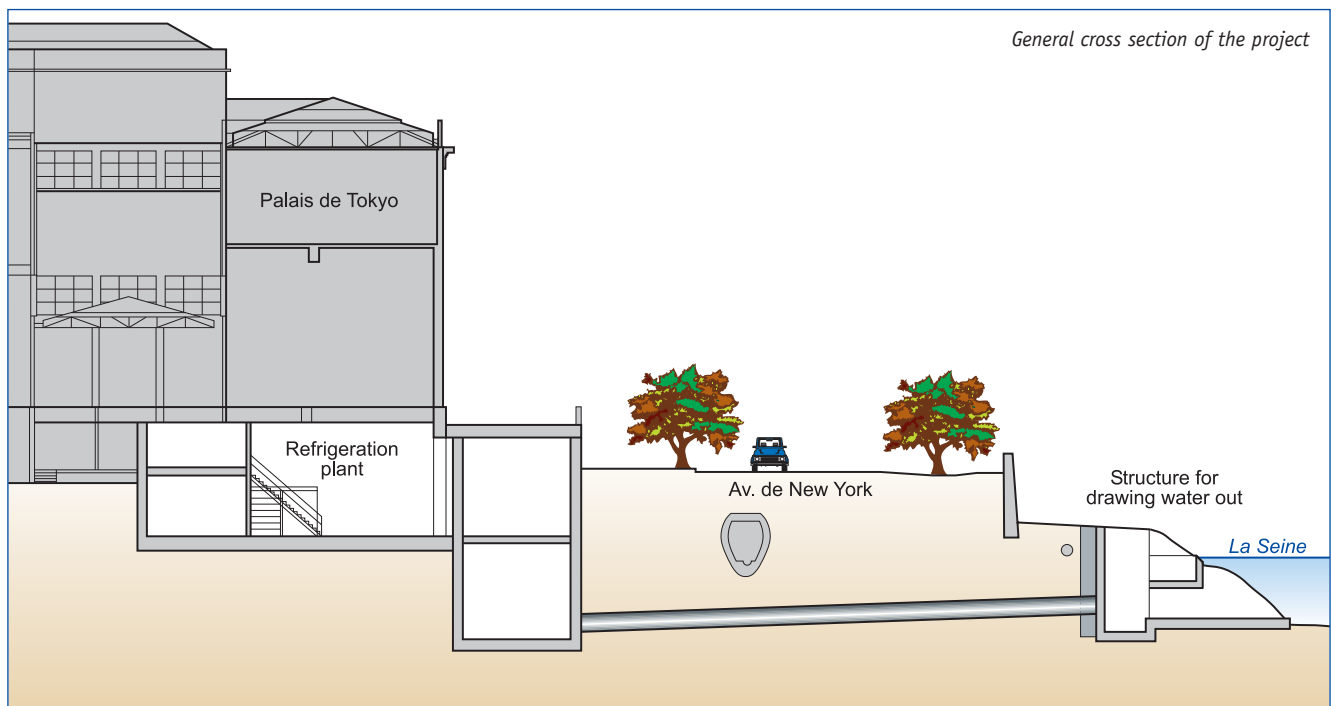
Diaphragm wall - Mini-Berlin wall - Nails - Micropiles - Ground anchors

## CLIMESPACE REFRIGERATING PLANT

PALAIS DE TOKYO - PARIS - FRANCE



### Special foundations for the construction of a refrigeration plant under the Palais de Tokyo in Paris



**A**s part of their “refrigeration” or “air-conditioning” installations, the Climespace Company has created a central refrigerating plant in the basements of the Palais de Tokyo in Paris. Solétanche Bachy France was awarded the contract for the construction of the special foundations designed to lower the floor of the existing basement by 4 m, thus enabling the structure to be built.

#### The refrigeration plant

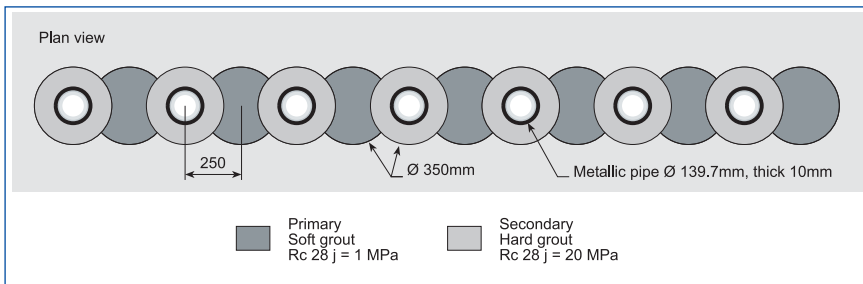
The plant consists of several interconnected structures:

- The water intake structure for drawing water out of the

CLIENT:	CLIMESPACE
ENGINEER:	INGEVALOR (PRINCIPAL), SAFEGE, DELTA GÉNIE ACOUSTIQUE
JOINT VENTURE RESPONSIBLE FOR SECTION 1 OF CIVIL AND SPECIAL WORKS:	DARRAS & JOUANIN (PRINCIPALS) / CHANTIERS MODERNES SOLÉTANCHE BACHY / CSM BESSAC
WORKS CARRIED OUT:	FROM JUNE 2005 TO NOVEMBER 2005

#### MAIN QUANTITIES:

- Mini-Berlin wall: 800 boreholes 10 and 12 metres in length drilled into cement-bentonite slurry using a 350mm tricône bit
- Self-drilling anchors: 206 drilled under sealing grout
- Micropiles used to underpin and anchor the floor: 483 bore holes under slurry using a 200mm tricône bit equipped with 10mm thick earth sealed pipes 139.7mm (columns) or 8.8mm thick 73mm (floor)
- 0.80m diaphragm wall: 13 sections - 1,600m<sup>2</sup> of excavations
- Temporary ground anchors: 10 ground anchors having a 25m 60t to 90t capacity
- Break-in/break-out for the TBM



Watertight chamber by micropile Berlin Wall

River Seine and another for discharge, located on the embankment,

- Two water supply pipes feeding the pumping tank,
- A discharge pipe to the discharge structure,
- The pumping tank located below the Palais de Tokyo "promenade" parallel to the avenue de New York,
- The actual central plant located partly below the existing basement area.

The presence of old foundations, the height and space restrictions and in the existing basements at the Palais de Tokyo meant that close attention had to be paid to the environmental impact at all times.

The structure is located adjacent to the River Seine where there are relatively poor quality recent and, ancient alluvia and a water table close to the level of the River Seine. A watertight temporary retaining structure in the form of contiguous micropiles and anchors was installed to allow



Column underpinning micropiles

Earth moving and Ground anchors



construction of the permanent structure. The existing columns at the Palais de Tokyo were underpinned using jacked micropiles, supplemented by permanent concrete columns placed throughout the height of the basement. The plant's base slab is subjected to hydrostatic pressure from below and was anchored using micropiles working in tension.

For the excavation for the pumping tank, a 0.80m thick diaphragm walled box was constructed with ground anchors, temporary struts, and a permanent foundation slab and floor to form a water tight box for both the temporary and permanent phases of the project.



The tunnel boring machine's route for the construction of water supply pipes from the pumping tank called for the installation of boxed out sections consisting of metal boxes filled with cement slurry in the diaphragm wall reinforcement cages