

Freezing

Soil improvement - Freezing with brine

LYONS NORTHERN RING ROAD (BPNL)

LYONS - FRANCE

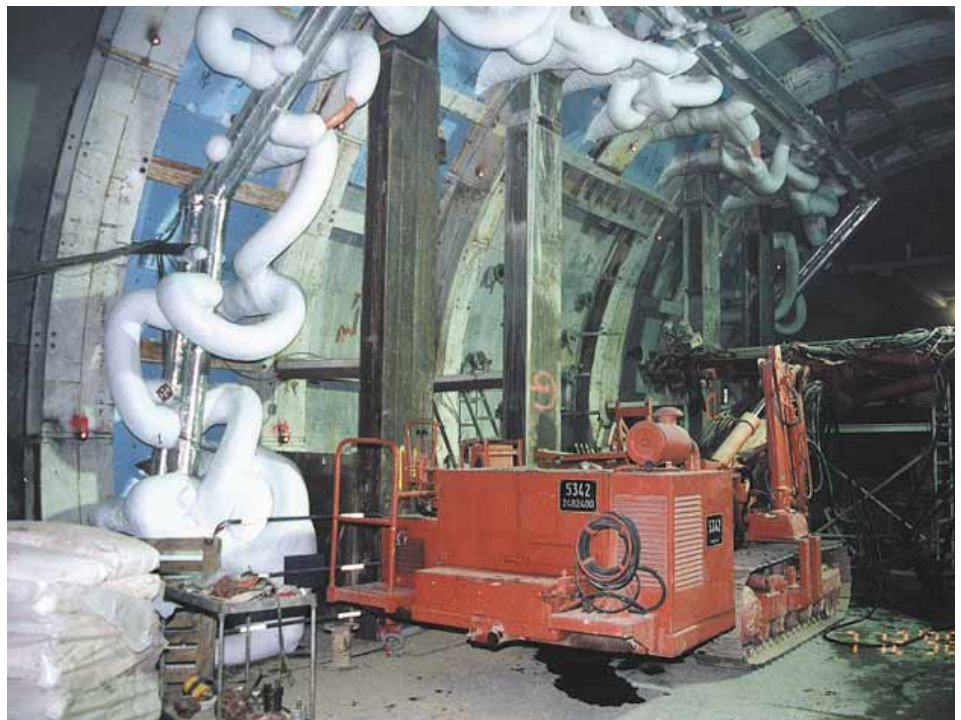


Full ground freezing in order to build interpipe 1725 S

One of the 7 Caluire motorway interpipes is located in a hydrogeologically hazardous area; excavation can only be performed with fully reliable protective treatment. Solétanche Bachy implemented the freezing process which enabled to excavate the pipe in all safety.

Caluire motorway interpipes (Lyons) are linked to each other, every 400 m or so, by safety interpipes. One out of two is of limited size (pedestrian path), while the others have road gauges, except for transverse structure "1725 South" which has a 3.30 m by 5 m gauge.

The latter must be built in a particularly sensitive geological and hydrogeological environment, as gneiss is found there (North pipe side), and mixed thin to thick alluvium of extremely variable permeability, as well as very fine molassic sand, which is very sensitive when emptying (South pipe side). Hydrostatic load is about 18 m above the tunnel axis. Freezing enables to work while being protected mechanically by a wall of ice. Such total



Freezing with brine

CLIENT:	COURLY (LYONS URBAN COMMUNITY)
GENERAL PARTNER:	GIE LYON NORD
MAIN CONTRACTOR:	SCETAURROUTE
SUBCONTRACTOR:	SOLETANCHE BACHY - INTRAFOR
"MOE" ADVISER:	GÉOCONSEIL
WORKS PERIOD:	JULY 1998 TO FEBRUARY 1999

WORKS PERFORMED

Southern Ring

- 49 freezing borings
- 12 borings equipped with temperature probes

Northern Ring

- 49 freezing borings
- 12 borings equipped with temperature probes

imperviousness results in 100 % safety both for men and structures. Restraints for transporting and using nitrogen in the tunnel have led to selecting the brine freezing technique, despite additional delay.

Freezing criteria

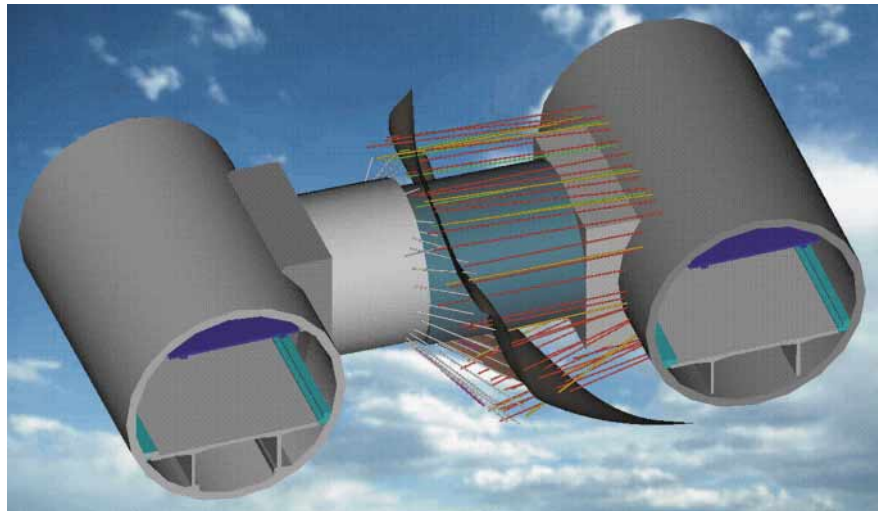
Two interpenetrating rings had to be built in order to guarantee imperviousness; one from the South pipe and the other from the North pipe. The North pipe was already open to traffic, so boring and equipment operations had to be performed from the small pipe entrance, cut into the rock. Before opening the section and after closing the ice wall, the latter had to be at least 1 m thick between -12°C isotherms.

Building

• Studies and boring

The Southern ring included 49 freezing borings and 12 borings with temperature probes; borings were performed via rotopercussion under a screen, with a 4" pipe, in which the freezing probe was placed.

The northern ring included 39 short freezing borings and 12 borings with temperature probes; borings were performed through a screen, but in atmospheric pressure. Work was performed without interrupting North pipe road traffic.



3-D scale model of structure

Once piercing was over and before cooling was performed, the tunnel was arched in order to temporarily work on rings, before building the framework.

Then, brine flow circuits were installed, the North pipe being fed by the South pipe, via 2 connection borings. The study and piercing phase lasted about 4 months.

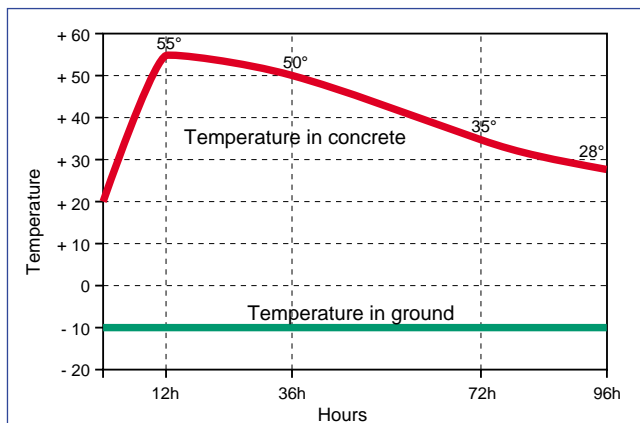
• Cooling

Two 100-Kw refrigerating units, installed in the South tunnel, performed cooling. Frozen shell closure was checked by rising pressure in piezometers installed in the interpipe bore, and took place after 30 days. Analysis of temperature measurements showed

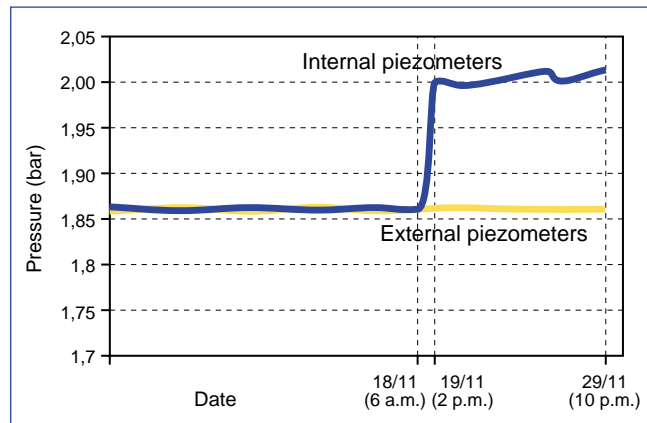
that the required criteria was reached after 6 weeks.

Excavation work lasted about 2 months, under protective arches and discharged concrete. Structure concrete was poured in 3 phases.

The interpipe took 4½ months to produce.



Concreting influence



Frozen shell closure