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ROCK - SOIL TECHNOLOGY AND EQUIPMENTS

PACCHIOSI DRILL

TUNNEL

MEYSSIEZ (FRANCIA)

MEYSSIEZ (FRANCE)

PROJECT:

Consolidation for protection of the excavation of a section of the Meyssiez tunnel built to extend the TGV Paris-Valence railroad line.

PERIOD OF EXECUTION:

1992-1993

CLIENT:

S.N.C.F. TGV RHONE-ALPES

Fig. 1. View of tunnel entrance.

Purpose of the work, difficulties encountered and solutions applied.

The excavation of the Meyssiez tunnel (Fig. 1), already completed in half section along its full length (1787 meter), had been interrupted in November 1991 due to signs of weakness shown in the dome between progressive points 287 and 353. Decompression of the sandy terrain, following the excavation, had caused the preliminary covering cambers (type HEB 220), which had already been installed, as well as a general lowering of the cap. The geotechnical features of the overhanging rock mass had been made precarious by the presence of sand lacking cohesion and affected by an abundant circulation of water, which could be seen from the many infiltrations throughout the length of the tunnel. The resistance of the rock that, during

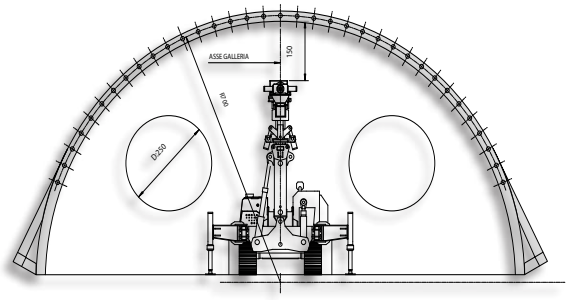

Fig. 2. Cross section of tunnel.

Fig. 3.View of Jet Grouting column fron test field.

the engineering stages, was estimated at about 800 kN/sq.m., was actually only 200 kN/sq.m. The first works, carried out to prevent further collapse, consisted in filling the tunnel section involved in the damage with concrete mixed with buildup soil. The passage between the two tunnel sections not involved in the damage was ensured by laying two cement pipes with a diameter of 2.5 m (Fig. 2). The subsequent stage concerned consolidation of the cap section involved in the collapse and the sides of the tunnel, to permit completion of the excavation under safe conditions (Fig. 2.

Lithology.

Deposits of fluvial and lacustrine origin consisting of marl, conglomerates, sandstone and sand.

Description of works.

The method applied to perform the works was the **Pacchiosi Jet Grouting System 1 (PS1)**. The system was tested with a field trial inside the tunnel, to optimize the injection parameters in relation to the characteristics of the soil to be treated. Six vertical columns 5 meters long will be built, with different injection timing, pressure, capacity, etc. Excavation of the columns served to measure the diameter and quality (Fig. 3). The

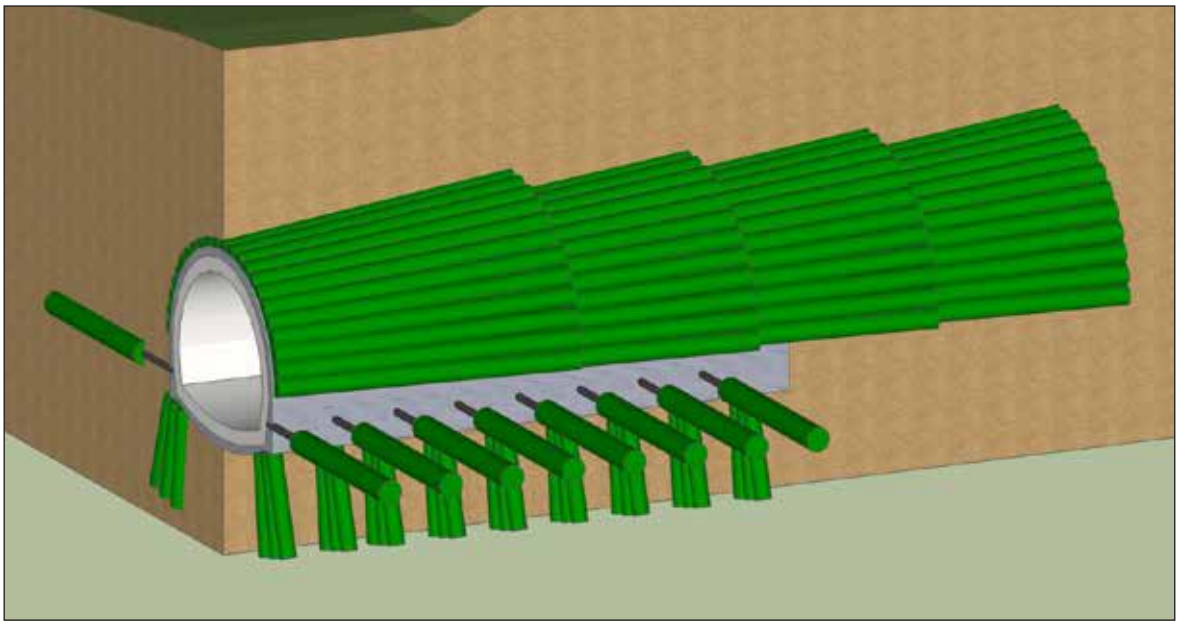

Fig. 4. Cross section of the tunnel with diagram of the works.

samples drawn and sent to the laboratory have average values of resistance to compression around 11.77 Mpa.

The works were divided into four separate stages (Fig. 4):

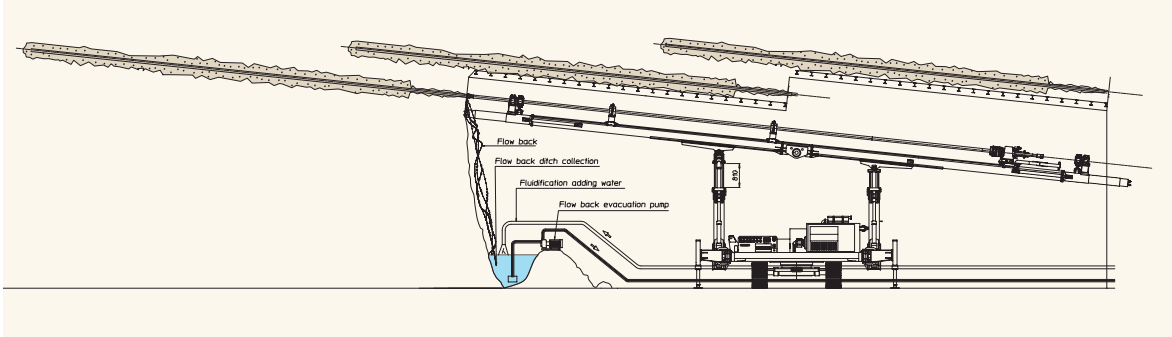

Fig. 5. Sketch of the intervention on voult.

Fig. 6 - 7. View of the P 1500 TAF drill rig used for consolidation of the vault.

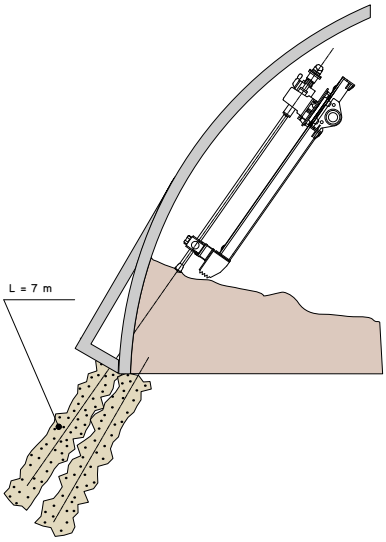

Fig. 8. Cross section view of the tunnel showing the works on the piers.

Fig. 9. PRP 105 D drill rig consolidating the piers.

- Consolidation of the cap. The works were carried out using sub-horizontal columns with a spacing of 50 cm, reinforced with steel piping, 15 m long, with a diameter of 60 cm; the excavation was guaranteed by the overlapping of the reinforced columns (minimum 7 m) (Fig. 5 -7);
- Consolidation of the piers. The works consisted of two sets of columns with variable inclination, not reinforced, 7 m long with a diameter of 60 cm (Fig. 8-9);
- Installation of reinforcing micropiles at the foot of the cambers. The works consisted of construction of a row of tilted columns at a 45° angle, with a spacing of 1.73 cm, reinforced with steel piping, 9 m long with a diameter of 60 cm (Fig. 10-11);
- Construction of anchorages on the cambers. The works consisted of construction of a row of sub-horizontal columns reinforced with dywidag bars (26.5 mm) 6 m long, with a diameter of 40 cm (Fig. 12);

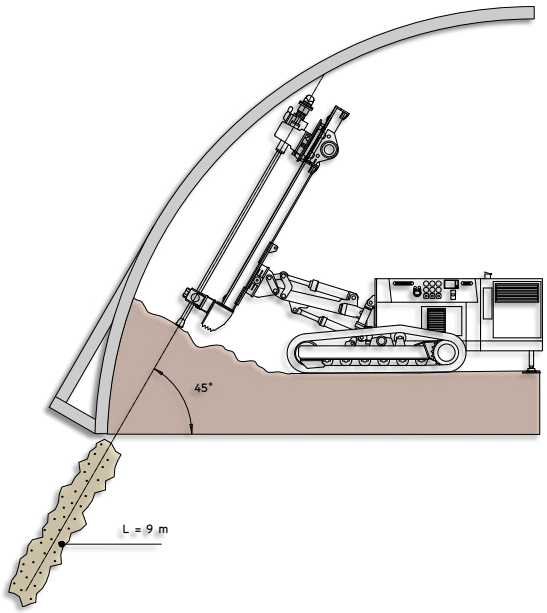

Fig. 10. Cross section of the tunnel showing works on the cambers.

Fig. 11. PRP 105 D drill rig during construction of the reinforced columns.

Fig. 12. PRP 105 D drill rig during anchorage of the cambers.

The excavation of this section of the tunnel, consolidated with the PS1 system was completed under completely safe conditions, without further damage.

FIG. 13. Views of worksite.

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