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ROCK - SOIL TECHNOLOGY AND EQUIPMENTS

PACCHIOSI DRILL

WATERPROOFING

NEW YORK (U.S.A.) -

NEW YORK (U.S.A.)

PROJECT:

Construction of 3 diaphragms with Jet Grouting technology for protection of the excavation of two tunnels under 5 existing lines of the New York subway system.

PERIOD OF CONSTRUCTION:

1995 - 1997

CLIENT:

N.Y.C.T.A. (New York City Transit Authority).

Fig. 1. 3D illustration of the work area with cross-section view and model with view from ground level.

Purpose of the work, difficulties encountered and solutions applied.

The need to accommodate the flow of passengers of the New York (Queens) subway system, induced the authorities to build a new station, constructing two connecting tunnels under the 5 existing subway lines. The works of consolidation and waterproofing consists of construction of three crosswise diaphragms (walls A, B and C) below the existing subway lines (Fig. 2). The client, N.Y.C.T.A., imposed the following specifications:

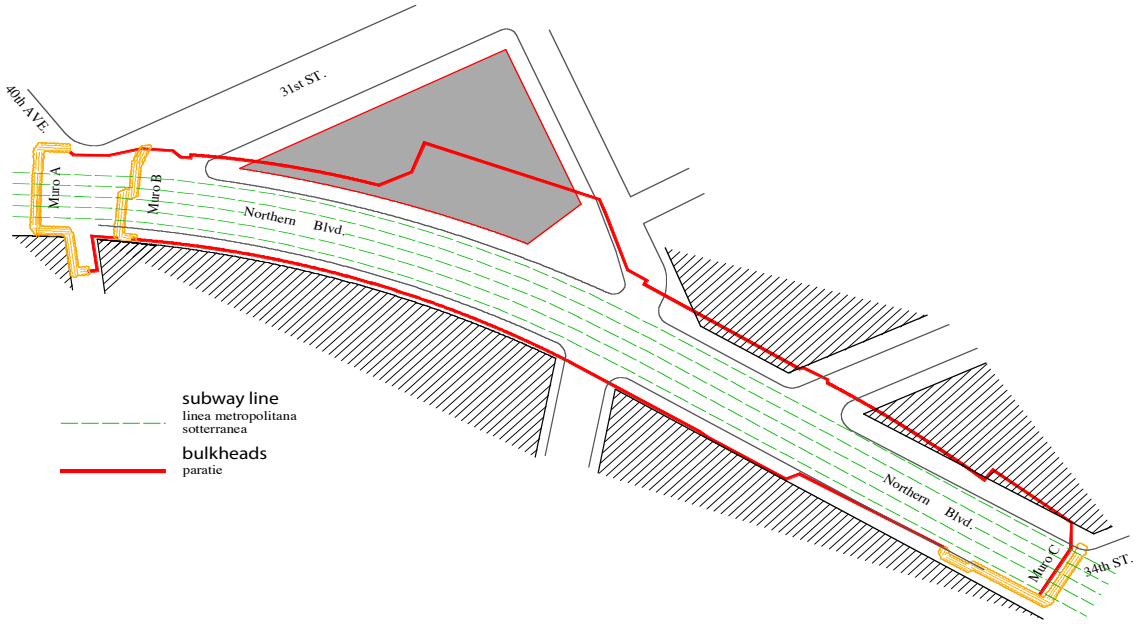


Fig. 2. Drawing of works.

- performance of the works from the outside;
- prohibition to interfere with road traffic, rail traffic and the circulation of subway trains (Fig. 3);
- limits on the height for certain stages of the work.

It was also necessary to use particular attention with regard to

Fig. 3. P 1000 probe.

cleaning the work areas, especially in the tunnels, and avoid disturbing the adjacent structures and buildings.

The works through subway tunnels were done during the night on the weekends, so as to ensure regular operation of the subway lines during working days. For performance

Fig. 4. P 1000 probe with short mast and automatic loader.

of the works with height limitations, a drilling machine with a short mast was prepared, with two loaders with 7 rods each, 2 meters long (Fig. 4).

Lithology.

Very compact glacial deposits with variable granulometry (from clay silt to large rock masses), interspersed with levels of peat. There is also a rock substrate consisting of gneiss. The level of the water table is 3 meters below the surface.

Description of works.

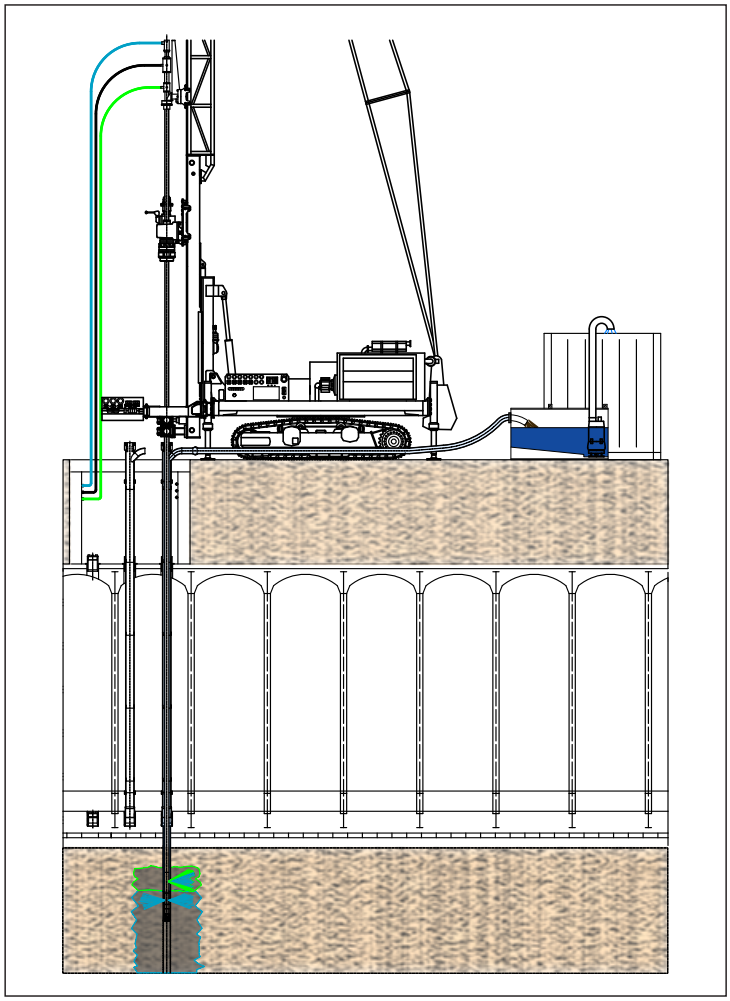
The construction of the three diaphragms was made with three parallel rows of columns using the Jet Grouting system PS3, arranged in a quincunx with variable spacing from 75 to 91 cm. The completion of each column involved the following steps:

- core sampling of the concrete on the vault and floor of the subway tunnels (only as regards wall C);
- application of metallic coating between the work surface and the terrain to be treated under the floor of the tunnels. The piping was sealed to the concrete floor to prevent the risk of leakage of drilling or injection fluids along the tunnels (only as regards wall C);

Fig. 5. Work stages of wall C.

Fig. 6. Waste fluid collection tank.

- installation of drilling and injection rods in the metallic covering (only as regards wall C),
- installation on the metallic covering of a device capable of intercepting the drilling and injection fluids and conveying them through a special pipeline to the collection and disposal tanks (limited to wall C) (Fig. 6);
- perforation to reach the rocky substrate;



- measurement of the verticality along the entire length of the tunnel, using the Pacchiosi Inclination Meter fitted directly inside the drilling rods. The data furnished by this instrument, after processing, gives the injection parameters to use for construction of the columns, in respect of the project specifications.
- construction of the column (Fig. 7).

Fig. 7. Drawing of construction of the Jet-Grouting column.

- The injection and drilling parameters of all the columns are registered with the automatic **Pacchiosi PRS3 system** (Fig. 8). The 55 control holes made with continuous core sampling during the performance of the works (on the average every 3 m of wall), served to verify the effectiveness of the treatments made, providing the following data:
- average values of resistance to compression: about 10 Mpa
- permeability values less than 1x10-8 m/sec.

Fig. 8. PRS3 data acquisition system.

Fig. 9. P 1000 probe used for Jet-Grouting.

The excavation revealed columns with diameters between 150 and 200 cm and wall thickness between 200 and 250 cm.

Fig. 10. Controls on Jet-Grouting.

Fig. 11. Controls on Jet-Grouting in the internal zone between walls A and B.

Fig. 12. View of the worksite.

Fig. 13. P 1500 ES probe during processing.

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Drill Pac S.r.l. – Società soggetta a direzione e coordinamento di Ghella S.p.A
Sede Legale: Via Pietro Borsieri, 2/a - 00195 Roma (RM)
Tel. +39 06 45603.1 – Fax +39 06 45603040 – e-mail: info@drillpac.com
Sede Operativa: Frazione Borgonovo, 22 – 43018 Sissa Trecasali (PR)
Tel. +39 0521 379003 – Fax +39 0521 879922 - **Sito web:** www.drillpac.com