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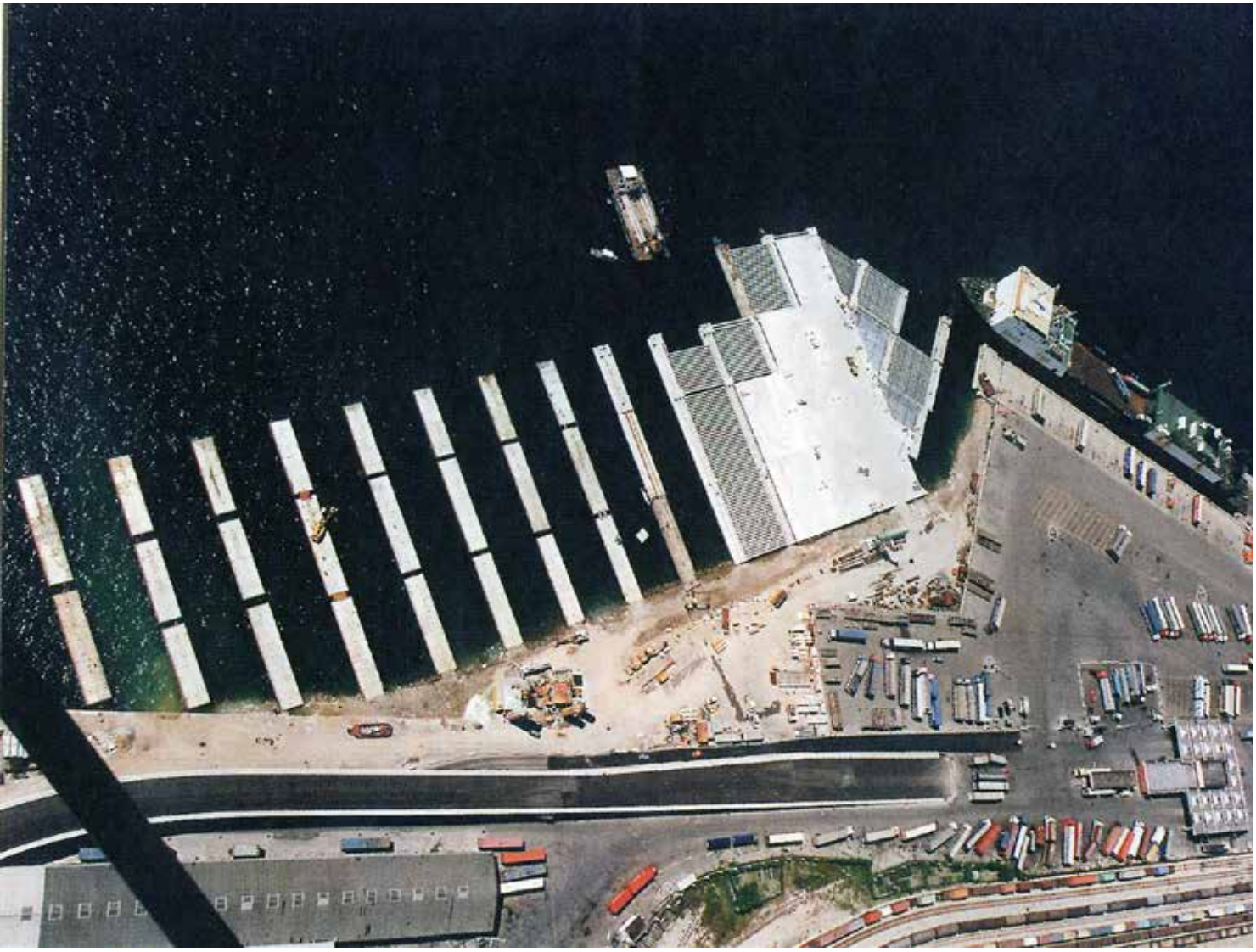
ROCK - SOIL TECHNOLOGY AND EQUIPMENTS

PACCHIOSI DRILL

CONSOLIDATIONS



TRIESTE (ITALY)

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PROJECT:

Construction of subfoundations for the support and anchorage of cellular caissons to the seabed, in order to enlarge the docking area of Riva Traiana to Punto Franco Nuovo, in Trieste harbour.

PERIOD OF EXECUTION:

1993-1994

CLIENT:

Port Authority of Trieste

Fig. 1. Aerial view oh the harbour.

Purpose of the work, difficulties encountered and solutions applied.

The need to expand the receiving capabilities of one section of the port of Trieste, known as Riva Traiana, induced the Authority to build new docking facilities. The project called for laying and anchoring cellular caissons in reinforced concrete to the bottom of the sea, after leveling it appropriately by adding soil. The very poor load-bearing capacity of the foundation soil made it necessary to perform works of consolidation, to improve the geotechnical characteristics. In addition to the innate complexity of the work, the project had to deal with adverse weather conditions (high tides, flood tides, high winds, etc.) and operating difficulties.

Lithology.

Seabed consisting of sandy mud and silt on densely stratified loamy sandstone (flysch).

Description of works.

The method chosen for this type of work is the Jet Grouting technique, optimized with the realization of a field test.

Test Field.

During the field tests, three different Jet Grouting systems were tested: **Pacchiosi PS2A, Pacchiosi PS2W and Pacchiosi PS3**. Nine Jet Grounding columns were built on a floating platform anchored in the open sea (Fig. 2). The columns, which were 12 m long, were built in soil similar to that found in the work zone (Fig. 3). The core samples of consolidated soil (Fig. 4), obtained by continuous core sampling and sent to a laboratory, indicated that the PS3 system was the most effective for this type of work. To optimize the parameters of the aforementioned system, an additional field test was made directly in the cellular caissons already positioned in the sea (Fig. 5), with three test columns in the space between two caissons. The core samples furnished samples of consolidated soil (Fig. 6) withvalues of resistance to compression between 7 and 9 Mpa, higher than the values required in the project prescriptions.

Fig. 4. Core samples from first test field.

Fig. 2. Test field pontoon.

Fig. 3. Underwater view of Jet Grouting column.

After establishing the height of the rock substratum with preliminary soundings and destruction of the nucleus, the machinery was placed directly on the cellular caissons positioned in the sea (Fig. 7).

Fig. 5. Campo prove sui cassoni.

Fig. 6. Carote provenienti dal secondo campo prove.

Fig. 7. P 1500 EC and PRP 1500 ECSdrill rigs during the execution of works.

The work plan was created with slabs of concrete set on top of the caissons, on which holes had been drilled in the preliminary stage, for the construction of the columns (Fig. 8-9). The procedure was carried out with three parallel rows of Jet Grouting columns, two on the edges of the caisson (Fig. 10) and one in line with the caisson.

The construction of each column involved the following stages of work:

- perforation (by coring) of the cellular caisson from the upper surface to the foundation soil;
- destructive perforation headed 2 meters into the rocky substrate (flysch), to pass the part of deteriorated rock;
- execution of the Jet Grouting PS3 column with a diameter of 1.80 m.

Fig. 8 - 9. View of cellular caissons(above) and preliminary holes (left).

Fig. 10. P 1500 ES drill rig performing Jet Grouting.

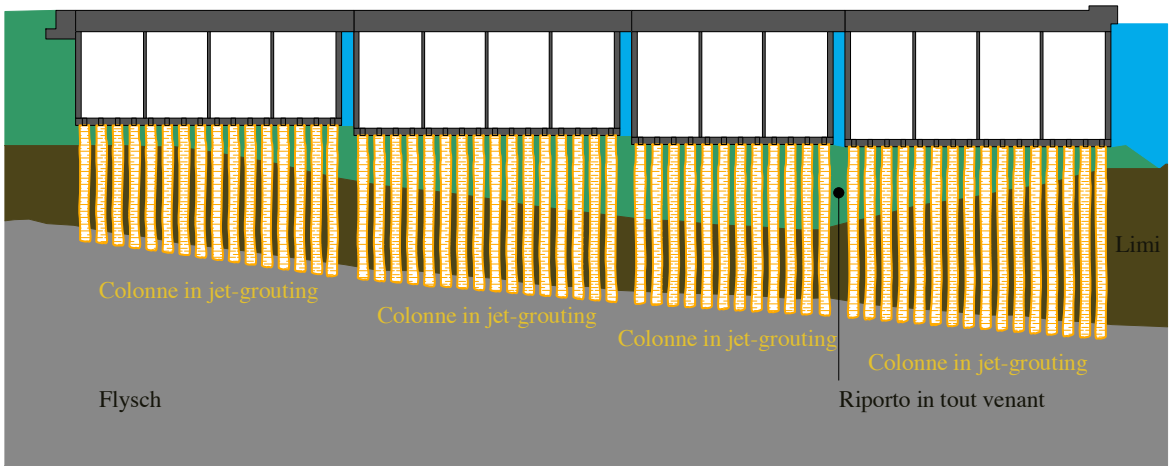

Fig. 11. Cross section of works.

Fig. 12. P 1500 ECS drill rig.

Fig. 13. View of the worksite.

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