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ROCK - SOIL TECHNOLOGY AND EQUIPMENTS

PACCHIOSI DRILL

CONSOLIDATIONS

TERMOLI PORT (CAMPOBASSO - ITALY)

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PROJECT:

Works of completion and adaptation of the docks at Termoli Port.

PERIOD OF CONSTRUCTION:

1998 – 2001

CLIENT:

Province of Campobasso

Fig. 1. View of the entrance to the docks at Termoli Port.

Fig. 2. View of the north dock at Termoli Port.

Purpose of the works, problems encountered and solutions applied.

The project for structural improvement of Termoli Port (CB) (Fig. 1-2 and Fig. 3) consists of four stages:

- completion of the port roadway system,
- construction of parking facilities;
- expansion and structural consolidation of the entrance dock;
- structural consolidation of the northern dock.

Stratigraphic profile of the docks.

Masses of cement conglomerate;

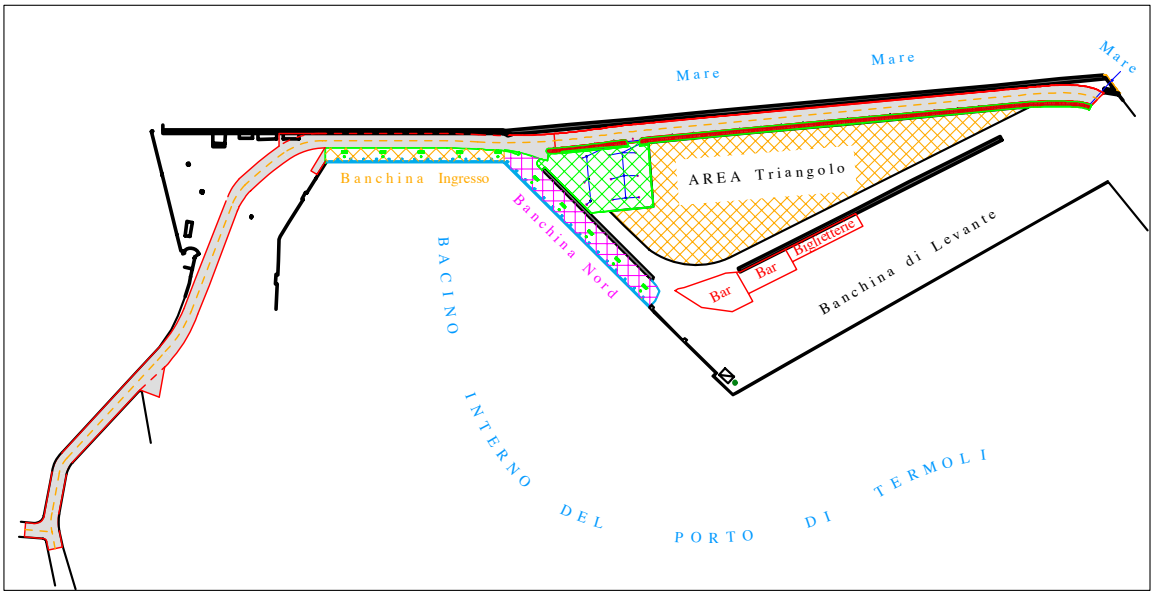


Fig. 3 Layout of Termoli Port.

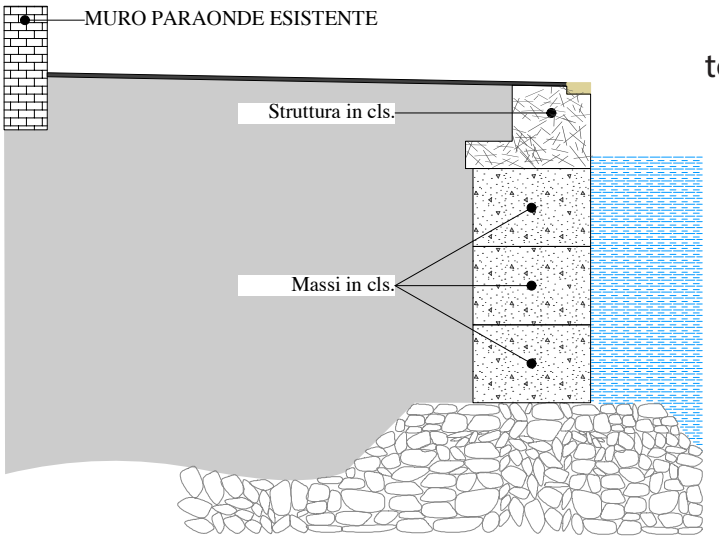
infill material with variable granulometry from fine sand blocks (D. 0.8 m);

Description of works.

The consolidation works relative to the two docks were carried out using two different methods.

Entrance dock

About 100 meters long, the dock is built on masses of ce-



to

Fig. 4. Cross section view of entrance dock prior to starting works.

ment conglomerate, resting on infill material with variable granulometry (Fig. 4.). The project called for its extension two meters seaward with projecting shelves build from structural elements in reinforced concrete (Fig. 5).

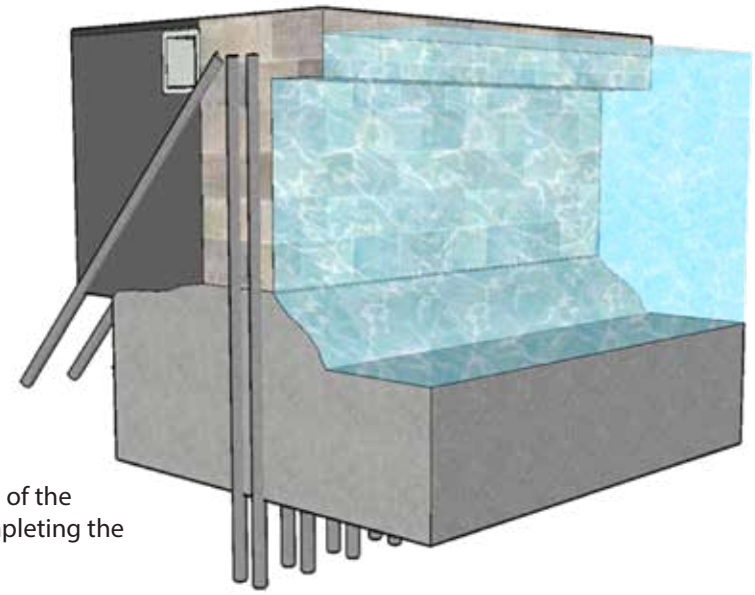


Fig. 5. 3D reconstruction of the entrance dock after completing the works.

Initially, the works consisted of consolidation of the existing wharf structure and foundation soil, with the installation of three rows of micropiles: two vertical rows blocked the concrete masses to the harbor bottom, improving stability, and one diagonal row prevented any possible sliding and tilting movements of the structure under construction.

Micropiles in the outer row:

- Distance from the outer row of the old dock: 0.70 m;
- Spacing: 1 m;
- Diameter: 220 mm;
- Length: 14 m;
- Reinforcement: Steel piping Fe52, diameter 146 mm, thickness 9 mm.

Micropiles in the inner row:

- Distance from the outer row of the old dock: 2.30 m;
- Spacing: 2 m;
- Diameter: 220 mm;
- Length: 14 m;
- Reinforcement: Steel piping Fe52, diameter 146 mm, thickness 9 mm.

Micropiles in the diagonal row:

- Distance: 1.90 m;
- Spacing: 2 m;
- Diameter: 220 mm;

Fig. 6-7. Launch of the prefabricated elements with detail of the operation.

Fig. 8. Detail of the micropile heads

Fig. 9. Detail of the projecting dock

- Length: 18 m;
- Reinforcement: Steel piping Fe52, diameter 88.9 mm, thickness 9 mm.
- Tilt: 45°.

The heads of all the micropiles were englobed in a bar of reinforced concrete conglomerate, in which the prefabricated elements were also inserted for construction of the projecting dock structure (Fig.6-9).

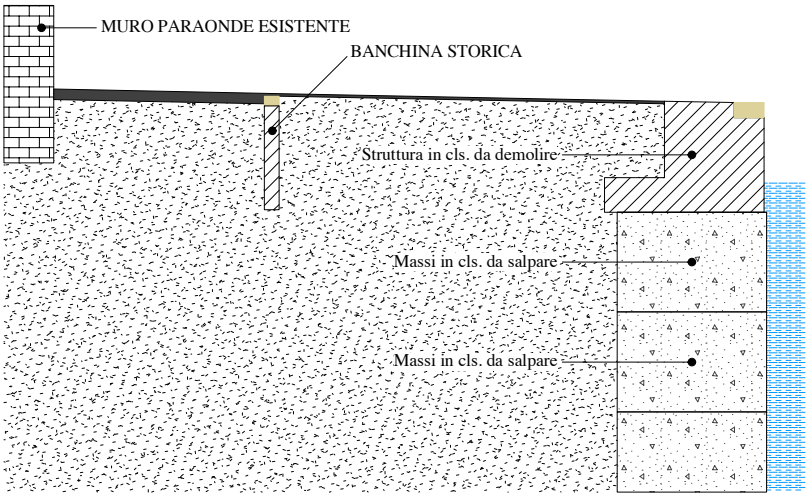


Fig. 10. Cross section view of the northern dock prior to starting works

Northern Dock.

The dock, which was about 115 meters long, was also built, like the entrance dock, on masses of cement conglomerate resting on infill material of variable granulometry (Fig. 10); the project called for reducing it by 2 m (Fig. 12).

The works, carried out in three stages, concerned construction of a waterproof bulkhead anchored to the masses of the dock structure (Fig. 11):

1. Construction of large diameter piles for consolidation of the dock foundation soil, having the following characteristics:

- Position: vertical;
- Spacing: 1.20 m;
- Reinforcement: metal cage.

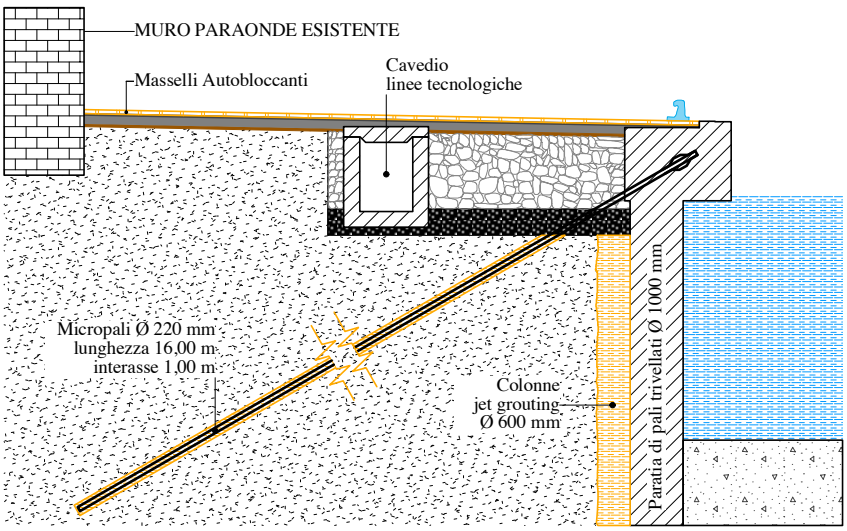


Fig. 11. Cross section view of the northern dock after works

Fig. 12. Demolition of part of the dock.

Fig. 13. Detail of the pile and micropile heads

2. Construction of Jet Grouting columns with the PSI system, between the piles, to seal any empty spaces and create a waterproof bulkhead with the following characteristics:

- Position: vertical;
- Diameter: 600 mm;
- Spacing: 1.20 m;
- Length: 10.50 m.

3. Construction of diagonal micropiles between the heads of the large diameter piles (Fig. 13), to ensure the stability of the structure, with the following characteristics:

- Tile: 45°;
- Spacing: 1.20 m;
- Diameter: 220 mm;
- Length: 16 m;
- Reinforcement: Steel piping Fe52, diameter 88.9 mm, thickness 9 mm.

Fig. 14. Reinforcement and carpentry of the bar.

Fig. 15. View of the new dock.

Fig. 16. P 1500 ECS and PRP 150 drilling rigs

Fig. 17. View of the worksite

The reinforcement of the large diameter piles and micropiles was englobed in a bar of reinforced concrete conglomerate (Fig. 14), to form the new dock (Fig. 15); on completion of the works the concrete masses were removed.

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