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ROCK - SOIL TECHNOLOGY AND EQUIPMENTS

PACCHIOSI DRILL

DRAINING SHAFTS AND CLOUJET

GRASSANO (MATERA - ITALY)

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PROJECT:

Consolidation of the town of Grassano by means of structural drainage shafts and nailed walls built with the Cloujet technique.

PERIOD OF EXECUTION:

February 1999 – June 2001

CLIENT:

Regione Basilicata
Department of infrastructures and mobility

Fig. 1.Main nailed wall.

Lithology.

Sand and conglomerates in layers over clay. On the top layer the sand is covered by a detritus cover of variable thickness.

Purpose of the work, difficulties and solutions applied.

The town of Grassano stands on a slope of the Basento valley where landslides are frequent; the problem involves the upper layers that tend to slide on the clay due to the heavy circulation of water in the lithological contact between the soil layers. It is especially frequent on the surface, where the detritus cover, characterized by very poor geotechnical properties, reveals a system of overlapping water tables.

To prevent the landslides from damaging the residential buildings of Grassano, the Regione Basilicata decided to construct works for control of the underground water tables and consolidate the areas of the slope more heavily affected by the damaging events (Fig. 2).

Description of works.

Drainages

The works were carried out by means of construction of three structural shafts having a very large diameters, in which sub-horizontal drainage pipes were installed. The waters collected in the shafts were drained through pipelines that connected the shafts to one another and conveyed into a surface drainage canal downstream.

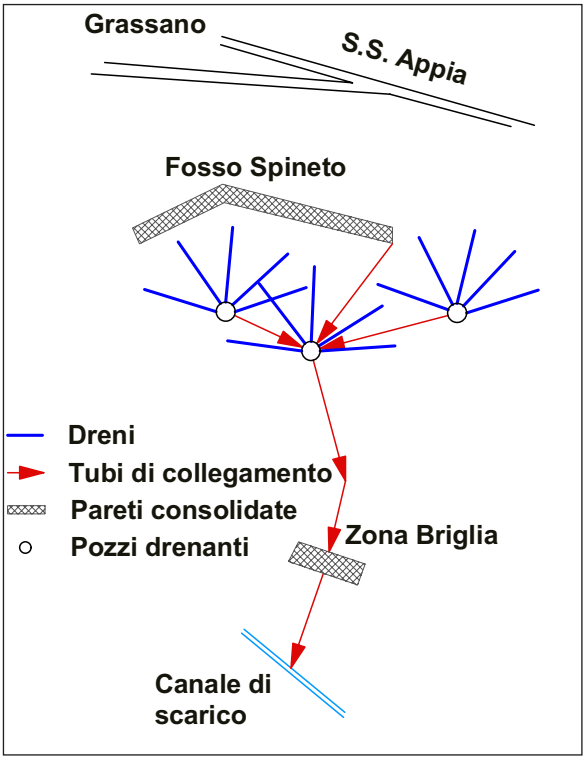


Fig. 2. Sketch of the works.

The procedure for construction of the shaft foundation consisted of the following steps:

- a construction of a crown of 14 poles with a diameter of 1.20 m and length of 21 m (Fig. 3);
- a excavation of the shaft (Fig. 4) and installation of cambers of advancement every 3 m (Fig. 5) till the depth of 15 meters;
- a pouring of the bottom plug in reinforced concrete, with a thickness of 1 m;
- a construction of the connecting pipelines between the wells and the drainage canal toward the valley;
- a construction of sub-horizontal drains to intercept the underground waters (three rows of 5 drains with variable inclination, length of 35 m);

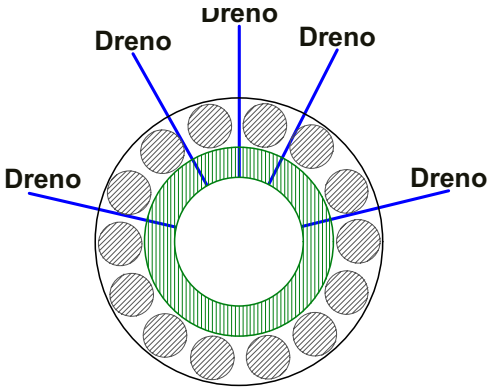
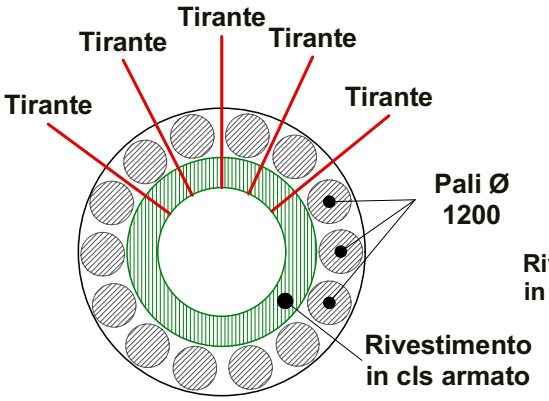


Fig. 3. Sections of a typical drainage shaft with construction parts.



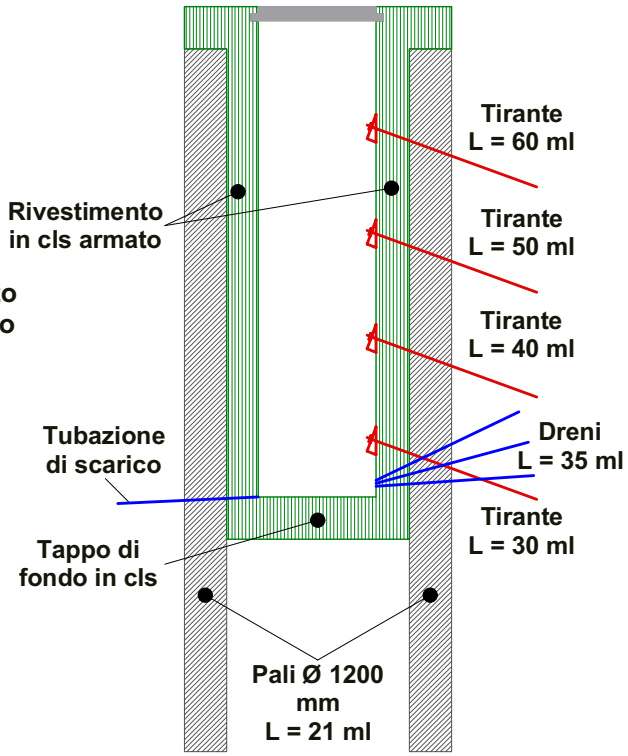


Fig. 4. Shaft excavation stage.

Fig. 5. Camtering installation stage.

Fig. 6. Formworks assembly stage.

Fig. 7. Shaft lining stage.

Fig. 8. Reinforcement of shaft bead.

- a lining of shaft with a layer of reinforced concrete (Fig. 6 and 7);
- a construction of anchoring tie rods, positioned on four levels (Fig 8 and 9).

Fig. 9. Installation of tie rods.

Fig. 10. Inside of shaft with a view of the tie rod heads.

Consolidation of the slope.

The works required stabilization of two different areas of the Fosso Spineto slope using Cloujet technology (Fig. 11).

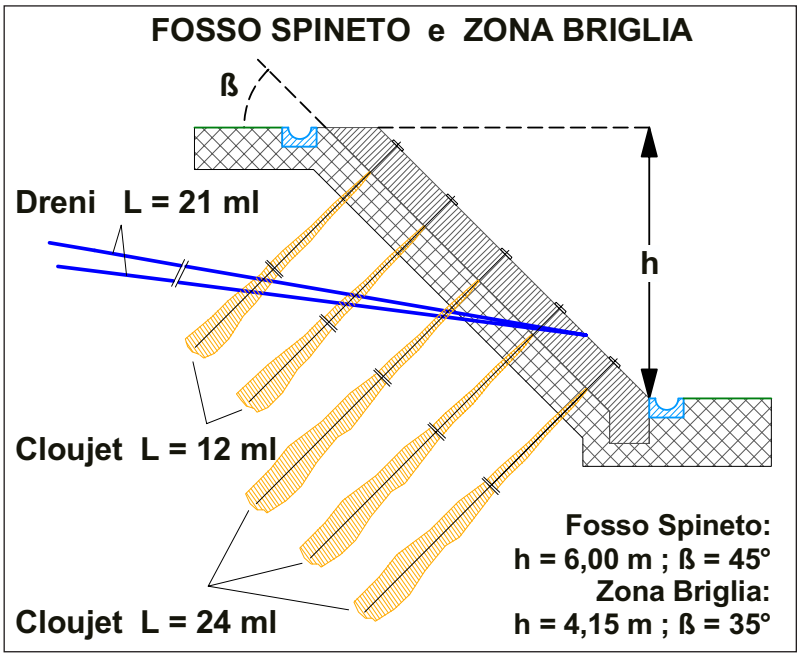


Fig. 11. Cross section of the slope showing construction features.

The following steps were involved:

- a excavation and construction of two walls tilted respectively by 45° and 35° depending on the different geological-geomorphological conditions;
- a installation of drain bands to eliminate the hydrostatic pressures behind the walls;
- a pouring of spryed concrete on the walls;
- a construction of tie rods with Jet Grouting columns reinforced with Diwidag (Cloujet) bars, with appropriate draft heads (Fig. 12);
- a construction of sub-horizontal drains to intercept any infiltrations in depth (Fig. 13).

The consolidated zones and the three structural shafts were connected together by underground pipes that discharge the water intercepted by the drains into the valley.

Fig. 12. View of the nailed wall.

Fig. 13. Canal into which the drains flow.

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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