



ALIANO (MATERA - ITALY)

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PROJECT:

Completion of Agri - Sauro hydraulic tunnel.

PERIOD OF EXECUTION:

October 98 – November 01

CLIENT:

Irrigation Authority for the Puglia, Lucania and Irpinia districts (Bari).



Fig. 1 - 2. Tunnel entrance from the side of the Sauro river during works (above) and after completion (underneath).



Lithology.

Clay silt and silty clay, with frequent sandy insertions of variable thickness.

Purpose of the work and difficulties encountered.

In 1981 the Bari Irrigation Authority undertook works for construction of a river tunnel to connect the waters of the Sauro river with those of the Agri river, to supply the reservoir at Monte Cotugno dam.

The tunnel, 6615 lin.mt. long with an internal diameter of 3.5 m. is covered with pre-fabricated slabs and was completed in February 1991. It was never possible to use it because of damage inside and several sites of breakage of the slabs (Fig. 3).

Also, in long sections of the tunnel, there were numerous infiltrations of water and silty sand, particularly at position 3450, where hundreds of cubic meters of material accumulated on the bottom (Fig. 4). This narrowed the gauge of the tunnel and damaged the covering slabs further. Following inspection of the geo-lithological conditions of the rock mass, it was possible



Fig. 3. Fissuring of slabs and water infiltrations.



Fig. 4. Accumulations of material along the tunnel.

to identify the constant presence of levels of sand, saturated with water, in the layers of clay silt and silty clay that had a strong thrusting action; the review of the project made a further works necessary to place the tunnel in safe conditions by installing a new covering that could counter the thrust generated by the rock mass and make the structure functional.

These works were assigned to Pacchiosi Drill S.p.A.

Description of works.

The main works were preceded by a complete cleaning of the tunnel (removal of the material accumulated on the floor, washing of the slabs and restoration of the tracks).

The final lining was installed by 60 m sections as works progressed, with pourings of fiber and steel-reinforced concrete, prepared outside and conveyed into the pouring zone by Beton trains (fig. 5), using modular hydraulic formworks (60 m long with an external diameter of 2.80 m) (fig. 6-7).

Fig. 5. Movement of the concrete in the tunnel for pouring.

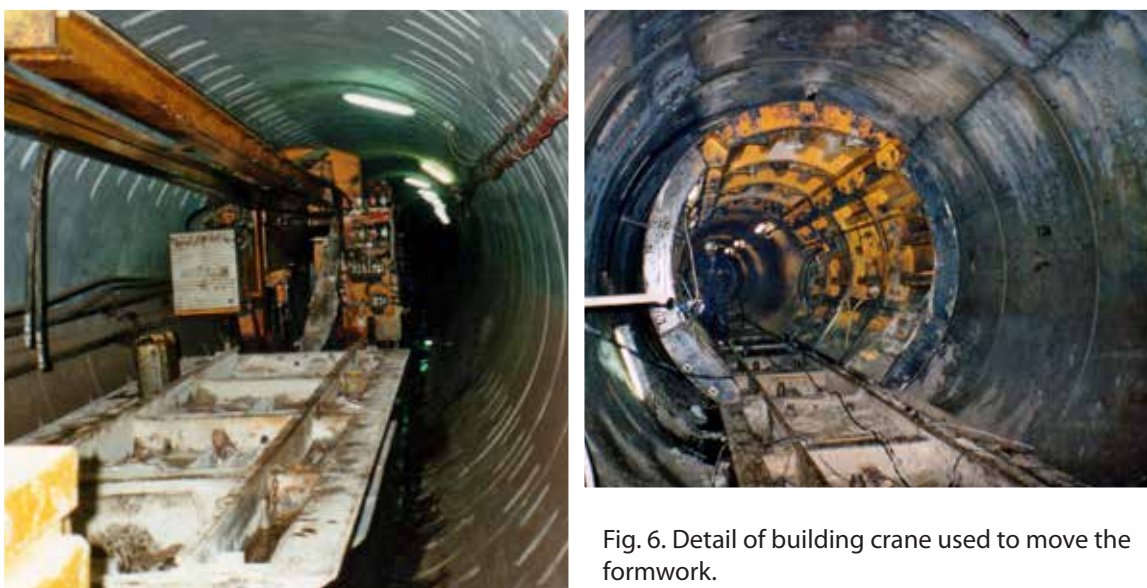


Fig. 6. Detail of building crane used to move the formwork.

Fig. 7. Pouring stage seen from inside the formwork.



Fig. 8. Movement of the pipe into the tunnel.

Fig. 9. Installation of pipe in the tunnel and injection.



The juncture between two adjacent sections of pouring was further waterproofed with the injection of foam resin and sealing of the joint after milling it (Fig. 9). The new covering of the tunnel was also waterproofed with a treatment involving osmotic penetration (Fig. 9).



Fig. 10. View of the worksite.

At the more severely damaged points, where the structural collapse was most accentuated, the concrete covering was poured after installing a steel pipe, adherent to the slabs, designed for radial perforations and subsequent injections of cement to consolidate the treated zone.

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tural collapse was most accentuated, the concrete covering was poured after installing a steel pipe, adherent to the slabs, designed for radial perforations and subsequent injections of cement to consolidate the zone treated. The works were performed under particularly difficult conditions, where the areas still to be covered had continuous infiltrations, causing the copious formation of mud that slowed the work.

After completing the covering, a tank in reinforced concrete was built at the entrance to the tunnel on the Agri river side, which would convey the waters from the Sauro into the bed of the Agri river (Fig. 11 - 12).



Fig. 11. Construction of the tank.



Fig. 12. Completed tank.

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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