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## 1. Water Reservoirs at Oran and Jebel Dzioua (Algeria)

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| *Owner:* | *Democratic People's Republic of Algeria, Ministry of Hydraulics, Environment and Forests, Algiers* |
| *Engineer:* | *ILF, Austria* |
| *Tank Design:* | *VSL INTERNATIONAL LTD, Berne, Switzerland* |
| *Contractor:* | *Joint Venture Zschokke-Dragados, Oran* |
| *Post-tensioning:* | *VSL INTERNATIONAL LTD, Berne, Switzerland* |
| *Construction Period:* | *September 1986 – April 1988* |

For the extension to the water supply of the city of Oran to bring drinking water to the town from the Tafna River, three reservoirs each of 50 000 $m^3$ capacity have recently been built. Two of them are located at Oran, the third at Jebel Dzioua (approx. 70 km south-west of Oran). Each structure has an internal diameter of 99 m, a wall thickness of 0.40 m and an internal height at the centre of 7.435 m. The 0.20 m thick roof is carried on square columns (0.54 × 0.54 m) on a grid of 8 × 8 m. Concrete with a cube compression strength at 28 days of 35 N/$mm^2$ was used throughout.

Whereas post-tensioning had been envisaged from the start for the walls, it was a proposal by VSL that led to the roofs also being built in post-tensioned concrete, instead of reinforced concrete. Apart from savings in materials, this also resulted in considerable advantages for the durability of the structures.

The reservoirs were constructed according to the following procedure: First the bottom slab, which is of reinforced concrete, was constructed. Then the ring foundation of the wall was cast and half of its post-tensioning tendons stressed to the design force. Subsequently the wall was constructed in 9 segments. When the wall was complete, its vertical tendons were stressed and also the up to then unstressed half of tendons of the ring foundation. Then the joint between the bottom slab and

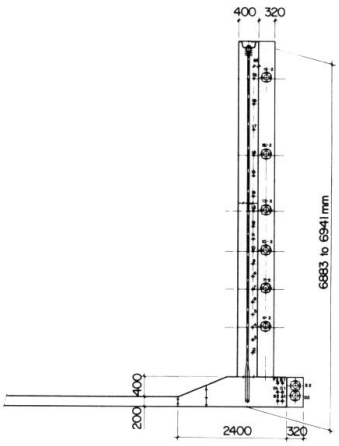


*Fig. 1 Cross-section of wall and ring foundation showing layout of horizontal and vertical post-tensioning tendons*

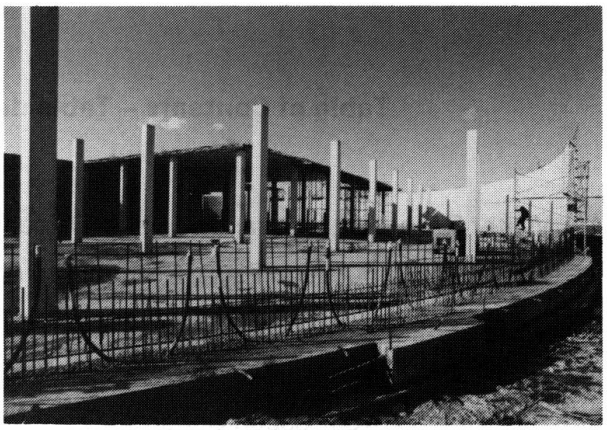

*Fig. 2 View of one of the tanks under construction; in the foreground VSL loop anchorages type L for the vertical wall tendons and a buttress with cables of the ring foundation can be seen*

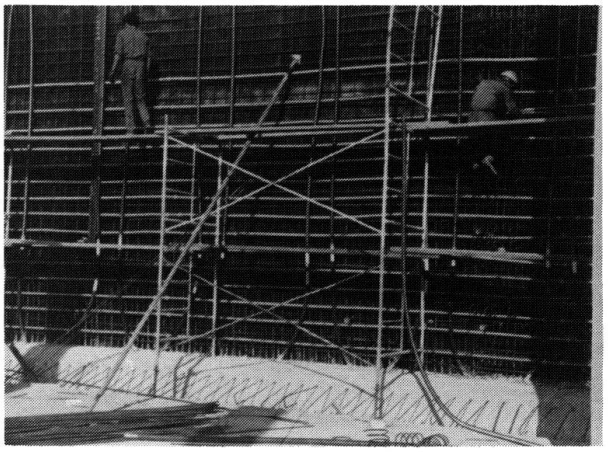

*Fig. 3 Placing of cable ducts in a wall segment*

the ring foundation was closed and the horizontal wall tendons stressed. Parallely the columns were constructed and the roof was carried out in 19 segments.

Each of the nine segments per wall contains one buttress to anchor the 18 hoops of horizontal tendons of type VSL EC/EC 5-7 which are distributed at varying spacing (250 to 500 mm) through the height. Vertical tendons EC/L/EC 5-4 are placed at regular intervals in the centre of the wall. The 0.60 m deep ring foundation contains 6 hoops of tendons EC/EC 5-7. Each hoop of the horizontal wall tendons and the ring foundation tendons is made up of 3 cables, each one covering one third of the circumference. The roof is orthogonally post-tensioned with VSL Monostrands Ø 15 mm (0.6"). While groups of 8 monostrands are concentrated in the column lines, four pairs of tendons are equally distributed in between. Since the roof was built in steps, the monostrands had to be provided with intermediate anchorages.

*(H. U. Aeberhard)*

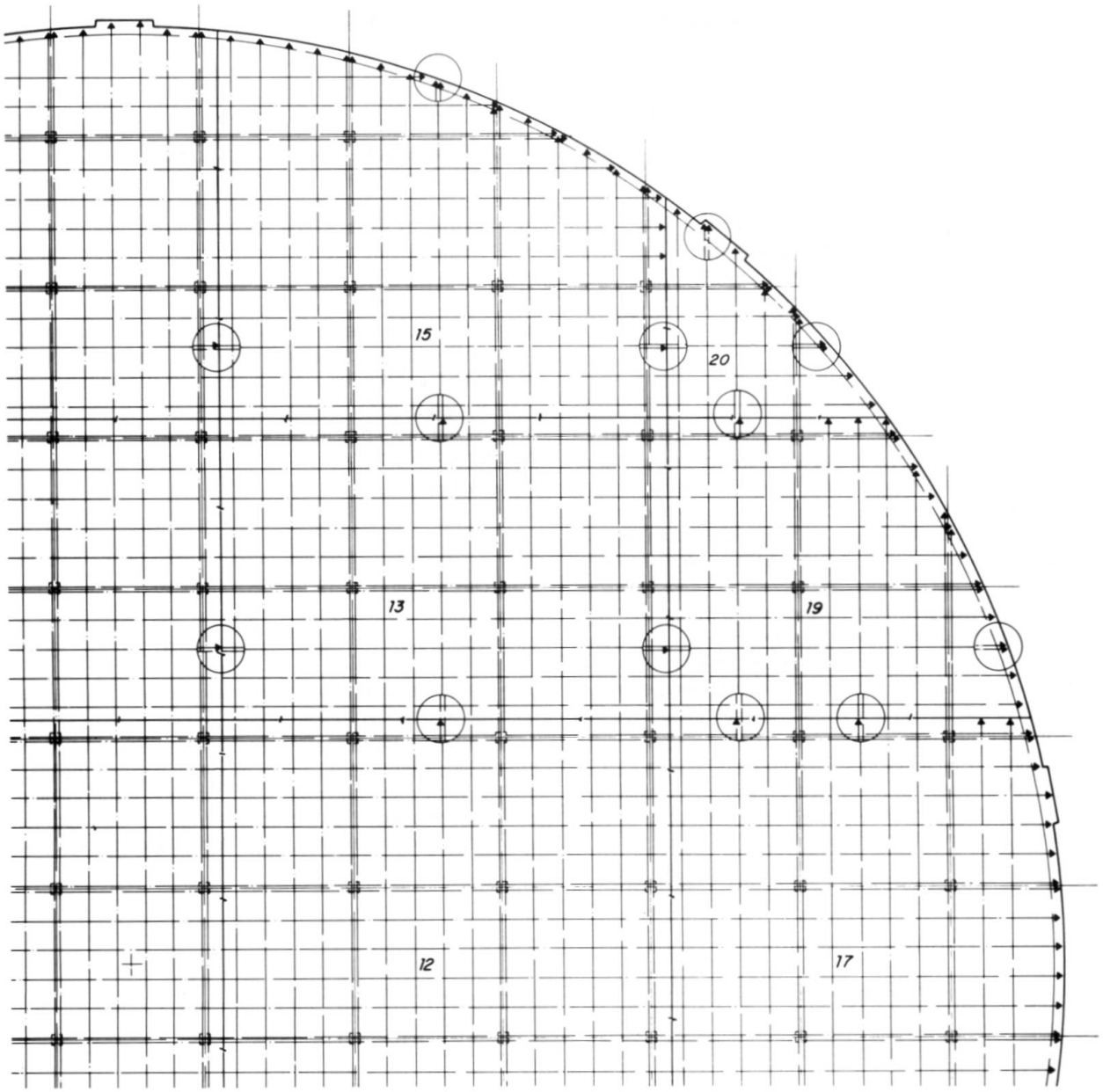


*Fig. 4 Partial view of cable layout in the roof*

*Fig. 5 Placing of VSL Monostrand tendons for the roof post-tensioning*

*Fig. 6 One of the roofs during concreting of a segment*