January 1979
S 20

JOB REPORT

VSL

VSL POST-TENSIONING
VSL HEAVY RIGGING
VSL SLIPFORMING

Water and Telecommunication Tower Mechelen, Belgium

Owner:	City of Mechelen
Engineers:	Design Office ITH, Mechelen Prof. Dr. F. Mortelmans, University of Leuven
Contractor:	Vanhout Vosselaar N.V., Vosselaar
Post-tensioning:	Civielco B.V., Leiden, Netherlands
Slipforming and Heavy Rigging:	Losinger Ltd., VSL International, Berne, Switzerland

Introduction

As a result of the population increase and the expansion of industry in the north and south of Mechelen, the municipal water supply system had to be extended and a new water tower had to be built in the southern industrial zone. At the same time, the television network needed to be improved with new antennas, and the radio, telephone and telegraph services had to be enlarged. Therefore the construction of a multipurpose tower was decided upon. In March 1977 the design of the structure was commissioned. Construction of the tower (estimated costs 85 million bfr.) started in February 1978; it was finished at the end of the same year.

The Structure in Detail

The tower rises to 143 m above ground level. Up to level 120 m it consists of a conical reinforced concrete shaft with an outside diameter of 9.20 m at the base and 3.40 m at the top. An arrow-like tube of stainless steel which has an aesthetic function only, tops the tower. The water tank, having a capacity of 2500 m^3, is situated between elevation 44.14 and 53.40 m. Just above it are the parabolic antennas for radio, telephone and telegraph. A platform at 110 m height carries the television equipment.

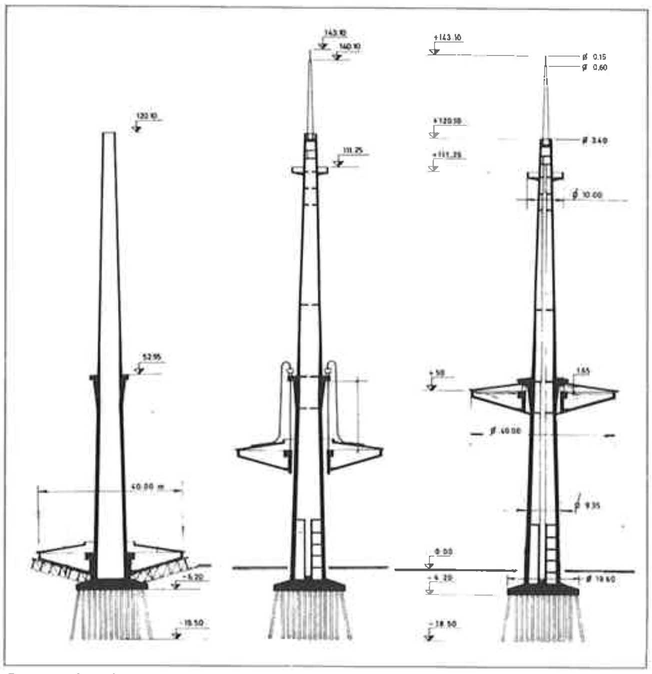
The tower shaft stands on a circular foundation slab of 19.60 m diameter and up to 3 m thickness which rests on 127 piles. The bottom of the foundation is 6.20 m below ground level. The tower wall has a thickness of 0.65 m up to the bottom of the water tank, except in the area around the access door where the thickness increases to 1.03 m. Above the bottom level of the water tank, the thickness of the shaft wall increases to 1.84 m over a distance of 7.81 m. There follows a ring beam of 10.64 m diameter and 1.00 m height. At level 52.95 m, the wall is 0.50 m thick; between 60.00 and 107.40 m the thickness is 0.40 m. Then it decreases linearly to remain constant at 0.20 m over the last 6.20 m of the top section.

The water tank has an outside diameter of 40 m. Its form is that of a flat shell with the bottom sloped at about 17° from horizontal. It is radially stiffened by 16 interior walls, each 0.35 m thick. The thickness of the bottom slab is 0.30 m. The tank is covered by a slightly sloped roof supported on the outer wall of the shell.

Construction Procedure

After construction of the piles and the foundation slab, the first 3.50 m of the tower shaft were carried out conventionally. Then VSL slipforming was used for constructing the shaft. This work was accomplished within 40 days as planned (i.e. between May 25 and July 4, 1978) although it was highly demanding because of the conical form and the various cross-sectional changes in the wall.

The storage shell and the roof were subsequently constructed at ground level. Special attention was paid to the formwork of the tank bottom in order to emphasize the position of the radial walls, thus giving the structure a pleasant architectural aspect. After concreting, the shell and the roof were post-tensioned, the cables were grouted and the block-outs filled. Then the structure was made ready for lifting, and the lifting operation was carried out. When the tank had reached its definitive position, the lifting cables were transformed into suspension cables. As their number would not have been sufficient for the service stage, additional suspension cables were installed in the tank while still at ground level and lifted with it. The cables were anchored on the ring beam, and then concrete columns were cast around the sheathed tendons. When the concrete had reached the required strength the suspension cables were stressed in order to keep the columns under permanent compression. Finally tower shaft and tank bottom were connected by cast-in-place concrete.



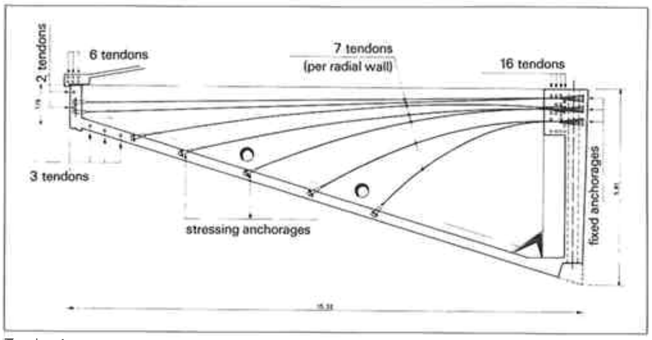
Construction phases

Post-tensioning

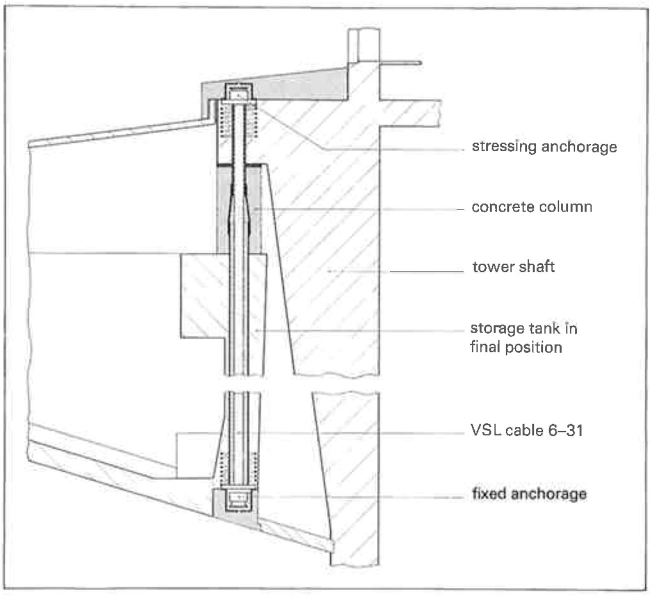
The water tank is post-tensioned by means of radial and circular cables. Each radial wall of the shell is provided with 7 VSL tendons type EU 6–7 (ultimate strength 1900 kN each). The fixed anchorages type U are placed in the ring beam topping the inner shell wall. The stressing anchorages are in the outer wall and in the shell bottom.

Circular tendons were required in the ring beam where the radial cables have their dead-ends, in the outer wall, in the outermost part of the shell bottom and in the tension ring of the roof. With the exception of the tendons in the inner ring beam of the shell which are of type EE 6–12, all cables consist of 7 strands dia. 15 mm (0.6") like the radial tendons. The cables typically cover half the circumference, thus having lengths between 15 and 62 m.

As mentioned before, post-tensioning was also used for the suspension of the tank from the tower shaft. For this purpose 16 VSL cables 6–31 (ultimate capacity per tendon 8450 kN) were required. These cables being short and straight, they were stressed by means of a single-strand jack while the other tendons were stressed with multi-strand jacks.



Tendon layout



Suspension of tank to tower shaft

Lifting

The storage tank, weighing 2600 metric tons, was lifted on November 6 to 8, 1978: The total lifting distance was 46.36 m. Eight VSL motive units SLU-330 equally distributed over the bracket ring beam at the tower shaft were used. Each lifting cable was anchored at the bottom of the inner shell ring by means of a VSL anchorage type EP 6–31. Four pumps EHPS-24 were used for driving the motive units. They were operated from one control console.

The strands used for lifting were cut to the required length on site, provided with compression fittings and bundled. Then they were connected to the bracket ring at the tower and the inner ring of the tank by means of a large mobile crane which was used for placing the precast elements of the platform at level 110 m.

Published by:

VSL International
Losinger Ltd.
Könizstrasse 74
3001 Berne
Switzerland

Civielco B.V.
Scheepmakerssteeg 2
hoek Rapenburg
2300 AG Leiden
Netherlands

VSL Prestressing
(Aust.) Pty. Ltd.
6, Pioneer Avenue
Thornleigh NSW 2120
Australia

VSL Corporation
101, Albright Way
P.O. Box 459
Los Gatos, CA 95030
USA