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Artikel: B J Vorster Microwave Tower, Pretoria (Rep. of South Africa)

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5. B J Vorster Microwave Tower, Pretoria (Rep. of South Africa)

Owner:	*Department of Posts & Telecommunications*
Architect:	*PWD Architectural Department*
Engineer:	*Ove Arup & Partners*
Contractor:	*Stocks – Futurus (Pty) Limited*
Works duration:	*27 months*
Service date:	*1980*

The J B Vorster Microwave Tower which was completed in 1980 forms an important link in South Africa's microwave telecommunications systems. The tower, which serves mainly a technical function, occupies a dominant position on a hill overlooking Pretoria. It therefore has an important impact on the skyline of the capital city and called for an appropriately distinctive architectural statement.

The brief was for a concrete tower 157 m high with a 20 m steel mast on top. The height was limited by considerations relating to the flight path to nearby Waterkloof airport. Three antenna platforms were required at the top of the concrete portion of the tower, with equipment and technical rooms immediately below them. A public access viewing platform was also required but was not to interfere with the technical functions of the tower.

At the base of the tower is a two-level service building constructed out of off-shutter concrete to match the finish of the tower.

The form of the tower was influenced by its height and the functional space requirements for lifts, staircase and ducts which dictated the shaft size. The tower is not very tall and it would have been impossible to achieve the visual appearance of a tall slender structure in view of the relatively large shaft sizes and the accommodation requirements at the top.

Various alternative forms were considered, including circular, rectangular, triangular and cruciform shafts. The form finally chosen was based on a rational visual expression of the functional requirements.

Each of the four separate shafts serves a distinct function: three are lift shafts while the central core accommodates the staircase and ducts for cables, ventilation, plumbing and other services.

This form also suited the brief in that it separated access to the public spaces and the technical areas. The functions were further separated by locating the public viewing platform well below the technical levels, where an adequate view of the city and its surroundings was still achieved.

To emphasize the visual expression of the shaft functions, each lift shaft is terminated just above the highest level it serves, namely the public viewing platform, the technical service floors and the top respectively.

The result is a distinctive sculptural form which reflects the function of its various elements and is in harmony with the predominantly linear appearance of the nearby University of South Africa buildings.

For structural reasons the three lift shafts and the central core had to be interlinked at various levels to ensure shear transfer between the vertical elements in resisting the wind loads and eccentric vertical loads. A series of wall beams and platforms were therefore integrated into the functional requirements and aesthetics of the tower.

Major cantilever platforms at two levels support the public viewing platform and the technical floors. The public viewing platform is a tapered hexagonal slab which also supports the columns from the roof above on its perimeter. The upper cantilever is more complex, being supported unsymmetrically on the central core and the two remaining lift shafts at that level. It cantilevers some 8 m beyond the central core and carries three floors and the roof of the technical service building on columns supported on its perimeter. It is a reinforced concrete slab with a maximum depth of 1,5 m tapering to 450 mm at the perimeter.

The unusual shape of the tower necessitated wind tunnel tests to determine the wind load parameters. The tests were carried out at the University of Pretoria on an aeroelastic model of scale 1 : 250. This enabled the force coefficient to be determined and the aerodynamic excitation to be investigated for various wind directions.

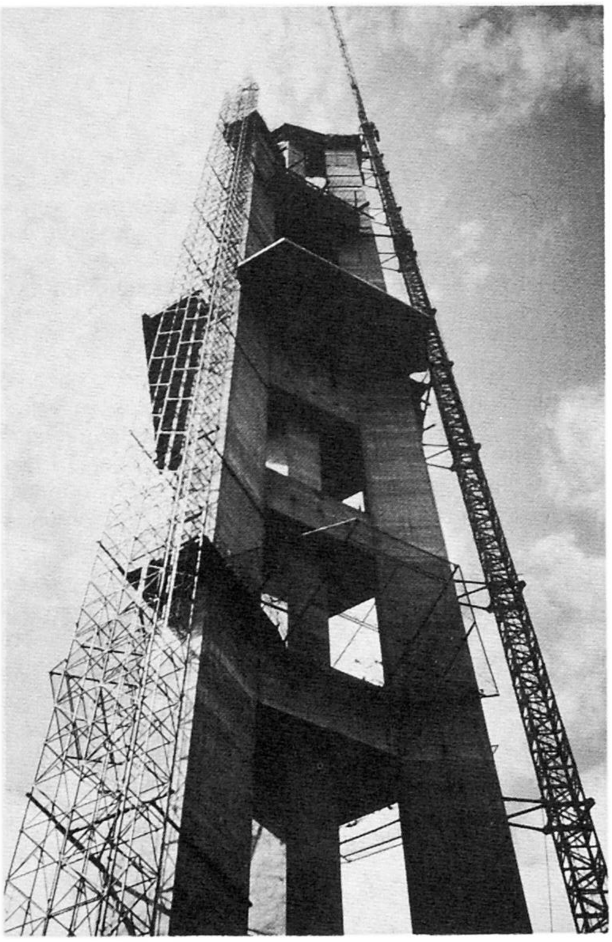
The structure was analysed using a space frame computer model to determine forces and moments for various wind directions.

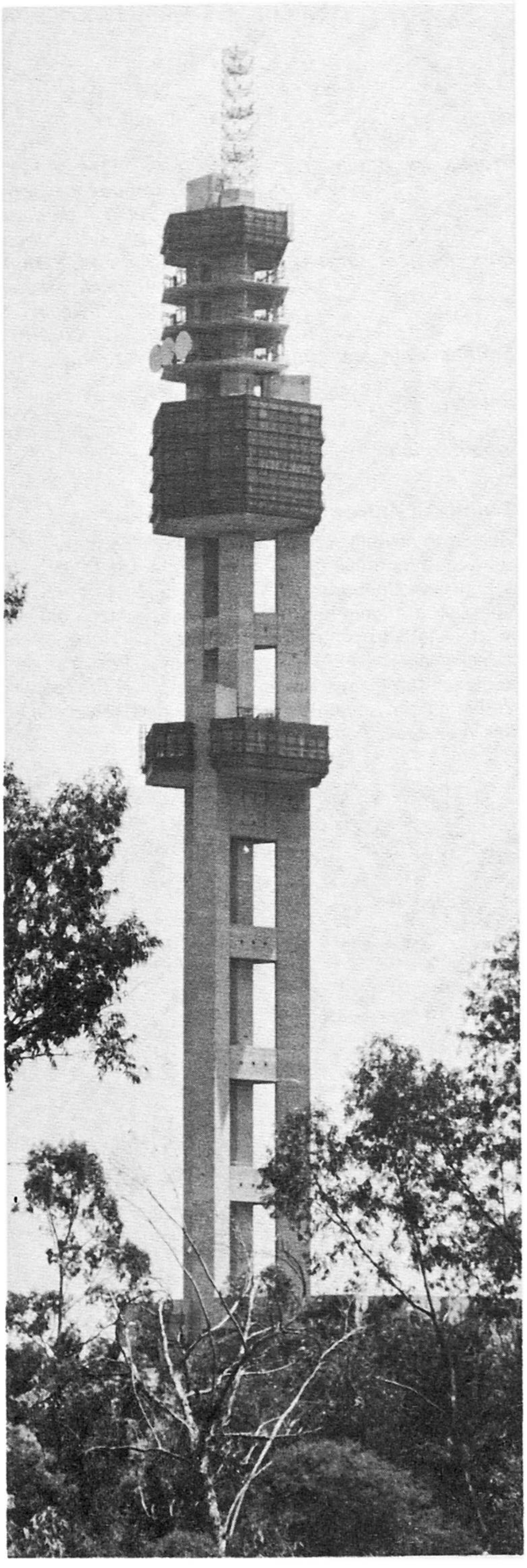
The tower is founded on a 3,5 m deep reinforced concrete raft of hexagonal shape. The underlying material comprises alternating layers of intact and weathered shale down to 30 m depths. There was some concern about possible settlement and rotation of the tower as a result of the variable proportion of weathered material in various boreholes. Down-the-hole pressure meter tests were therefore carried out to confirm the adequacy of the foundation.

Construction of the tower posed some interesting problems. The contractor opted for slip-forming for all the vertical elements including the wall beams. The procedure was to slide continuously to the underside of each wall beam, where steel soffit girders were fixed between the shafts. These girders formed the soffit and supported jacking rods to enable the wall beams to be slid concurrently with the shafts.

Particular care had to be taken to ensure a consistent and good quality finish, particularly as a stop/start procedure was required for sliding the wall beams, which were up to 8 m deep and entailed the fixing of heavy reinforcement. Curing was achieved using a resin based curing compound. The final finish achieved was exceptionally good.

The main cantilever platforms were constructed using a launching system with precast concrete soffit panels approximately 1,5 m square and 100 mm thick as the permanent shutter. A concrete anulus about 1,5 m deep was first cast around the shafts using conventional shuttering supported on steel brackets off the shafts. Radial steel cantilever beams were positioned above





this to support a series of transverse joists at their extremities. The precast soffit panels were supported on the completed concrete on the inside and hung by adjustable hangers from the transverse joists at their outer edge. Joints between panels were sealed using sealing cord and grout. The reinforcement was supported from the steelwork. The system was moved out after each successive pour. This enabled a high quality finish to be achieved on the underside and avoided the difficulty of having to remove shuttering from under the cantilevers.

(C. M. McMillan)