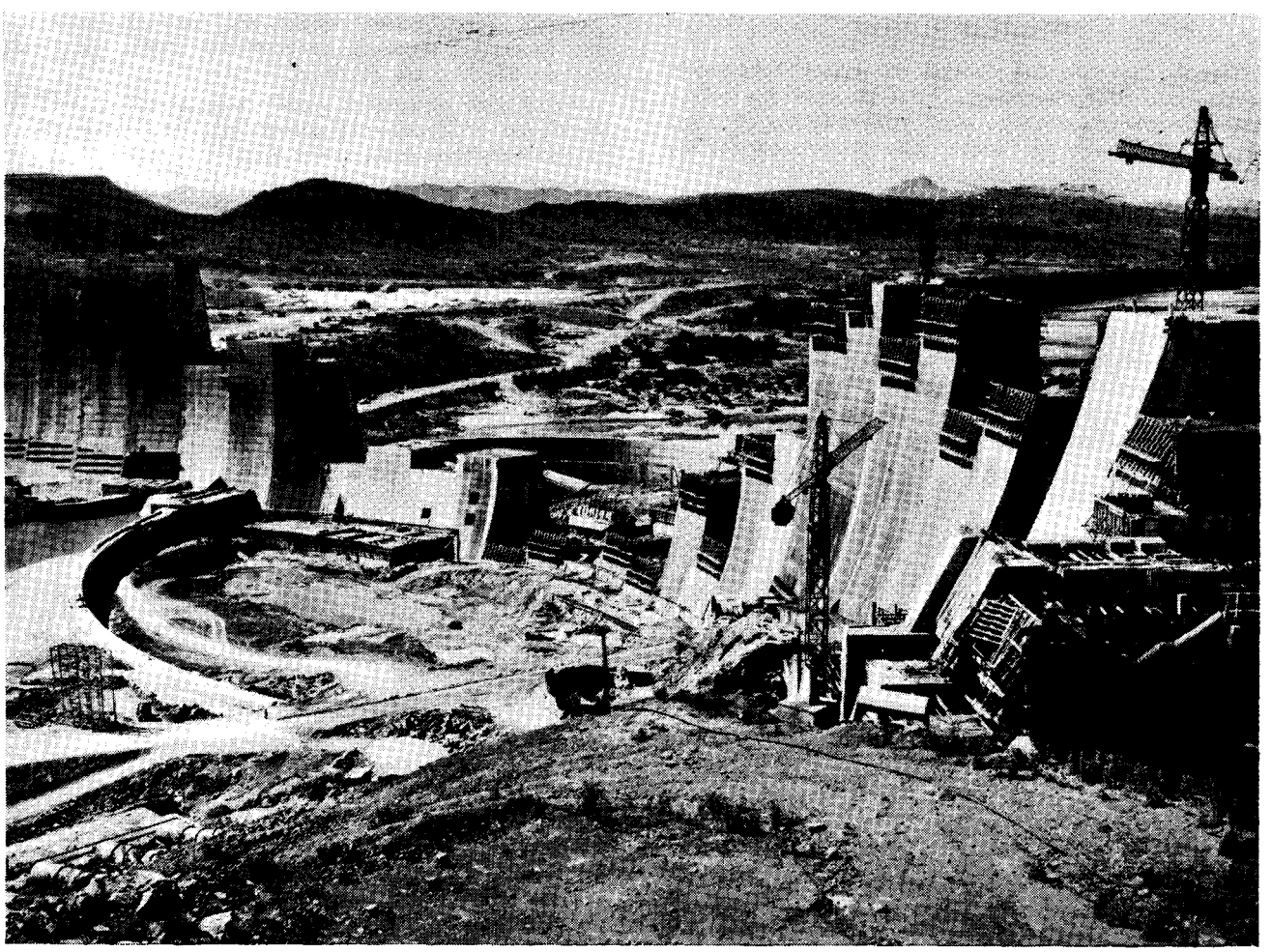
Visit to Hendrik Verwoerd Dam

On 23rd October, 1969, 54 members of the Institute set out at an early hour from Rand Airport in two chartered Dakota aircraft for a visit to the Hendrik Verwoerd Dam site. The weather was at the start rather unpromising but after passing Bloemfontein the overcast cleared and it turned into a glorious day for a most memorable visit.

The Institute is indebted to U.C.-Dumez-Borie Dams Limited, the main civil engineering contractors, and Mr J. D. McNamara their executive manager, for the very excellent arrangements made for this excursion. From the time the aircraft landed till a slightly belated departure the organisation of the extensive tours arranged for the parties was quite outstanding and a matter for congratulation to all concerned. At each of the many places visited there was a senior official to give an authoritative and comprehensive description of the work under his control. In addition the guides on the buses, loaned by the Department of Water Affairs, kept up an interesting running commentary throughout the day. A further much appreciated facet was the introduction of many of the experts on the site and a brief talk by each after an excellent lunch served at the recreation club. Each visitor also received a brochure with a progress report and a detailed site plan, with various sections highlighted in colour, and obviously prepared at the cost of much time and effort.

The visit included tours of the large dolerite quarry, where some 150 000 tons of rock are removed each month, the 42 in. gyratory primary crusher, the secondary crushing and screening plant, the rod mill plant for sand production, and the automated blending and concrete batching plant. The transport of mixed concrete by 'silobuses' to the 6 cu. yd buckets of four Blondin cableways, two of which are radially movable and two with buffing towers, and the placing of the concrete in the huge blocks of the wall was watched from a vantage point.

The most interesting part of the visit was without a doubt the inspection of the wall itself and the explanations of the many intricasies of its design and care in construction, covering aspects such as positioning of galleys, interlocking of blocks, reinforcement, refrigeration, actual concrete placing, subsequent grouting, etc. Other points of interest were the very complicated design of the wall itself, the river diversion plans, with three stages of coffer dams, the spillways, and the very well cut penstock tunnels.



General downstream view from the south bank (on 3rd October, 1969)

At the time of the visit the larger proportion of the individual 50 ft wide blocks, of which there will be 63, on the north and south banks had reached full height or were approaching this level, and the blocks of the centre portion had been started with the lowest block already some 30 ft above river bed. The very meagre flow of water in the river was being diverted through two openings in the north bank structure with a capacity of 50 000 cusecs, and it was a cause for wonder that anybody could expect to fill this huge dam; but only one week later a flood of some 65 000 cusecs overtopped the coffer dam and the lowest of the concrete blocks. Careful organisation provides for these interruptions, all equipment was withdrawn in good time, and work proceeded on other parts of the wall.

There were numerous other interesting aspects such as housing for the virtual 'United Nations' labour force on the site, the vast organisation and logistics problems, the relationship between client, consultant and contractor, the large labour force for construction of shuttering, the planning to make best use of this shuttering, and not lease the recreation facilities that have been built up in a fairly treeless part of the Orange Free State.

Whilst this project is largely a civil engineering undertaking there was a great deal of interest for the mining and metallurgical members of our Institute particularly as much of the work is being carried out by mining engineers and other senior staff drawn from mining companies.

PROGRESS REPORT

Broadly speaking, the Hendrik Verwoerd Dam can be divided into four main parts. First the centrally placed aesthetic double curvature main arch with the overspill topping the centre 15 blocks. This section carries the four lowly situated 8 ft dia silt outlet pipes.

Secondly the two massive intake sections situated on either flank of the main arch. These are functional sections of the dam and embedded in the wall on the right bank (northern or Free State side) are the two 10 ft dia river outlet pipes and the 7 ft dia Bloemfontein supply pipe (since destined for other areas). Cast into the wall on the left bank are the four 24 ft dia power (electric) penstock pipes. The six flood spillway openings are also situated in the intake sections; three on either bank, symmetrically positioned.

Thirdly there are the two gravity wing blocks situated at either extremity tapering off rapidly in width and height into the local hillsides.

Finally, the 'downstream works' consisting of six large concrete spillway chutes, one for each spillway opening; the valve houses for the river outlets and power penstock by-passes, plus the river training walls on both banks and the massive apron downstream of the overspill. The ESCOM four-turbined hydro-electric power station is also situated downstream on the Cape Province side.

Concrete is being poured, at a rate of 65 000 to 70 000 cubic yards per month. A total of 2·2 million cubic yards will be required to complete the project. The 3 200 ft long wall is split into 63 individual blocks along its longitudinal axis. Sub-divisions of these main blocks occur at various levels and stages bringing the total to 148. As a result, extensive shuttering is necessary to obtain even moderate volumes in concrete. Out of a total European labour force of 580 the main civil contractor employs some 200 on shuttering and ancillary works. Apart from special areas and on initial lifts (where timber is used) shuttering is of the steel panel type supported by 'soldiers' bolted into the faces of the previous lifts. Panels are raised either by means of small mobile cranes (transported from block to block by the aerial cableways) or by hand-windlass type tripods. Standard lifts are 7 ft in height and in the majority of blocks a lacing of 1 in. piping is cast into the concrete, carrying chilled water from a central refrigeration plant to provide the necessary cooling for the setting concrete. Reinforcing patterns naturally vary considerably throughout the wall but in certain sections are extremely dense with widespread use of 2 in. dia bars.

Work has proceeded swiftly and efficiently and the incidence of floods has fortunately been low—this is particularly important as the openings are presently only capable of dealing with a flow of 50 000 cusecs. These central blocks, and the key 'water control' blocks in the intakes, are now forging ahead in order to meet the date of *river closure* before the flood season 1970/71. The dam builders have thus only once more to challenge the muddy race of the Orange River. (*One week after these notes were written the Orange River had one more attempt at defeating the 'dam' builders, when a flood of 65 000 cusecs overtopped the coffer dam and the lowest of the central blocks.* Editor.)

P.W.J.v.R.

Book Review

NEW BOOKLET FOR POTENTIAL ENGINEERS

A new booklet "Professional Careers in Engineering" for issue to high school students who are considering engineering as a profession has been prepared for general distribution. The booklet is intended to help high school students to decide whether a career as a professional engineer would appeal to them, and to tell them how to set about becoming a professional engineer.

Copies of the booklet may be obtained free of charge by writing to:

The Federation of Societies of Professional Engineers, P.O. Box 5907, Johannesburg.