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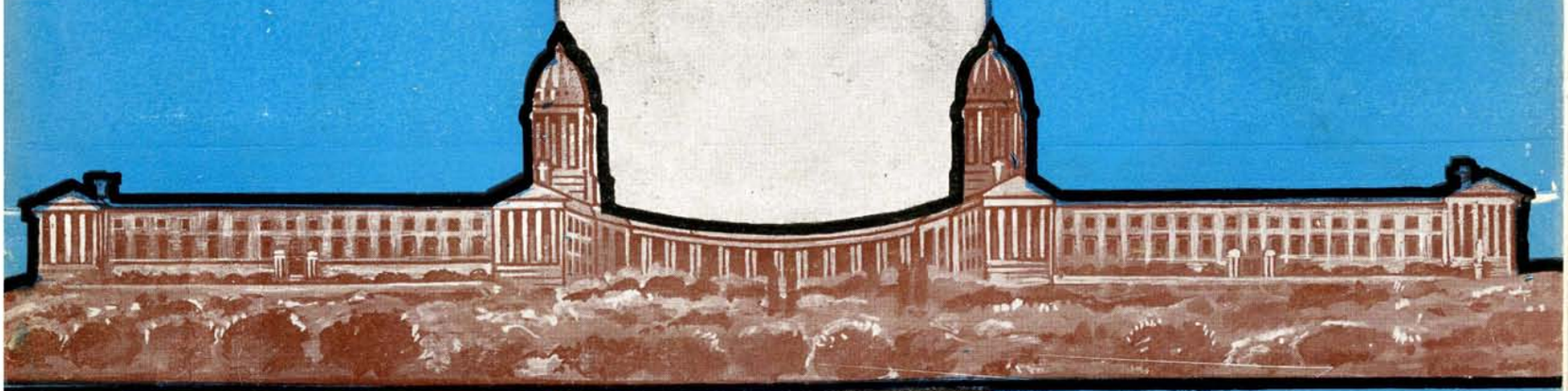

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PUBLIC WORKS OF SOUTH AFRICA, which is published monthly, is intended to keep the public up-to-date in regard to the engineering and building projects of the Central Government and the Provincial and Municipal Governments of South Africa

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CONTENTS

PHOTOGRAPH: S.A.R.

PRINCESS ELIZABETH AT THE OPENING OF THE NEW GRAVING DOCK AT EAST LONDON

THE PRINCESS ELIZABETH GRAVING DOCK EAST LONDON

ON 3rd March, 1947, with the gracious consent of His Majesty, Her Royal Highness Princess Elizabeth opened the new Graving Dock in East London, which bears her name.

The commissioning of the Princess Elizabeth Dock means that South Africa has graving docks at strategic points on its long coast line. The Sturrock Dock at Cape Town is the largest in the British Commonwealth and can accommodate the biggest ships in commission. Cape Town also has a smaller dock, the Robinson Dock, while Durban's dry dock has a long period of successful operation to its credit. During the war years battleships of the Barham Class were repaired and overhauled there.

In designing the comprehensive facilities available at S.A. ports, the S.A.R. which operate and control all harbours have not only taken into account the tremendous advances in recent years of agriculture, mining, industries and commerce, but have also made provision for future progress. Planning had to be on a generous scale. The whole country is pulsating with vigorous life, and the railways have framed their plans accordingly.

The decision to provide a graving dock at East London was hastened but not entirely dictated by conditions arising out of the war. With its strategic situation on South Africa's east coast, its growing significance as a manufacturing and distributing centre and its safe and sheltered harbour, East London is being favoured to an ever increasing degree as a port of call, and ship-repair facilities are a demonstrable need.

Although graving docks cannot be regarded as commercial propositions in the dividend-paying sense of the term, conditions at East London are such as to hold out the hope that shipping firms will recognise the many advantages of making use of the modern, well-equipped dock which has now been provided by the South African Railways.

While the site for the dock was selected as far back as 1926, it was not possible to make a serious start with construction work until early in 1944. It was always recognised that the building of a graving dock at East London would involve a host of engineering problems, since the only possible site was in the bed of a creek which discharged into the Buffalo River. This creek had to be diverted, a long tunnel had to be specially built, a road had to be re-surveyed and two reinforced concrete bridges had to be provided. The labour position was not easy at any time during the construction period — skilled labour was particularly difficult to obtain and materials were often in short supply. Indeed, cement deliveries were at one stage completely suspended. Nevertheless, reasonable progress was maintained and the whole work completed in the space of thirty-three months, a satisfactory record in view of the magnitude of the problems that had to be solved.

The total cost of the dock was approximately £2,471,000 ; the value of the Admiralty's contribution, which included all construction plant, as well as the permanent operating plant and equipment, was £411,489.

Negotiations for the construction of this dock were completed in London by the Minister of Transport, the Hon. F. C. Sturrock, in 1942. The work was done under the control and direction of the Chief Civil Engineer, South African Railways, Mr. J. S. de V. von Willich, B.Sc., A.M.I.C.E., while the engineer in charge of construction on the site was Mr. G. H. Deas, M.B.E., B.Sc., A.M.I.C.E., Harbour Engineer, East London. The construction was carried out as a departmental work by the South African Railways.

REPORT BY THE CONSTRUCTION ENGINEER

Mr. G. H. DEAS, M.B.E., B.Sc., A.M.I.C.E.

LOCATION

Owing to the congested nature of the area available, the site practically selected itself as it was controlled, at the entrance, by the turning area, 750 feet in diameter, required for shipping at the upstream portion of West Quay, and at the fore end, by a rail and road bridge to the west bank. Owing to the prevailing westerly winds, which blow across the entrance to the dock, it was necessary to provide a landing quay alongside which vessels could be brought before being warped into the dock. In addition, provision had to be made, as an extension of the landing quay, for a repair quay at which all work other than underwater repairs could be undertaken.

Broadly, therefore, the project resolved itself into three major items :— —

(1) A graving dock, 686 feet 3 inches long 89 feet 3 inches wide at copes, with a depth on sill of 33 feet 6 inches H.W.O.S.T.

(2) 684 feet of landing quay with a depth of water of 30 feet L.W.O.S.T.

(3) 650 feet of repair quay with a dredged depth of 35 feet L.W.O.S.T.

By tucking the graving dock well into the area known as First Creek is was just possible to fit in all the facilities required, but this necessitated two major works before the site could become available for construction.

DIVERSION OF GABBANGA RIVER (FIRST CREEK).

The first was the diversion of the Gabbanga River, which normally flows as a small brook, but which attains flood discharges of some 3,000 cubic feet per second. In order to cope with the run-off from a fully built-up area, which will result as the city expands, the diversion works have been designed to carry away some 7,790 cubic feet per second.

The diversion was commenced in May, 1943, and the flow of the Gabbanga River (First Creek) was turned through it during a small freshet in August, 1944. To complete this work it was necessary to construct 420 feet of twenty-foot by twenty foot culvert, much of it at a depth of forty-six feet below the surrounding area, and then 572 feet of tunnel of similar cross section, which in turn discharges into an open channel some 400 feet long and forty feet deep at the point of maximum depth.

The culvert portion was founded on bedrock so as to seal off seepage of floodwater to the dock. Some difficulty was encountered where the culvert portion approached the tunnel portion, since at this point it crossed the original creek bed where the rock dipped steeply to a level of eleven feet six inches below water. At this level, fresh and salt water seepage into the excavation became so excessive that it was necessary to construct a cofferdam to contain it.

Steel-sheet piling was used, and the cramped nature of the site necessitated these piles being driven by a hammer suspended from a crane. Thereafter the excavation was speedily completed. The concrete foundation was cast against the steel-sheet piling which was later extracted when the abutments had been completed.

The construction of the tunnel portion went hand in hand with the construction of the culvert portion.

An 8′ by 8′ adit was driven from either end to meet somewhere in the centre, the excavated material being removed by two foot gauge tip trucks which were manhandled. It was necessary to employ wet sinkers on this work owing to the dusty nature of the rock. This resulted in foggy conditions at the adit heads until the adits met, thereafter a strong natural draught enabled the tunnel proper to be driven in more hygienic conditions, and it was also possible to use motorised tip trucks for disposal of the excavation without any danger of carbon monoxide poisoning. Being in hard solid rock no shoring was necessary during the excavation of the tunnel, but 300 feet from the entrance a fault was traversed which subsequently commenced falling in. This portion was therefore retained by a grille of scrap rails, which was later encased in the concrete lining of the tunnel.

DEVIATION OF PONTOON ROAD

The second preliminary major work involved was the deviation of a road, and although this deviation is only 860 feet in length, it involved the construction of two large reinforced concrete overhead bridges, a new harbour road, also with an overhead bridge, and two deep cuttings through solid rock situated alongside a public road.

The first overhead bridge to be constructed carries the deviated Pontoon Road over the main-line to West Bank. The crossing is unavoidably at an angle, and at this very spot, some fifty seven feet below the surface, is the original creek bed. The filling, which was dumped in this vicinity during the construction of the main-line to West Bank in 1905, was not sufficiently consolidated to support the bridge, and it was necessary to provide a foundation on reinforced concrete piles. Two-hundred-and-thirty-six of these piles, weighing up to four tons each, were driven down to bedrock and the reinforced concrete superstructure erected thereon.

Although First Creek had at this time been diverted, it was not possible to fill in the old diversion work since the latter afforded the only possible rail route

for the disposal of spoil from the graving dock site.

The bridge was accordingly designed to suit the site, and the span was increased to enable the abutments to be founded on solid rock on either side of the old diversion works. The additional length of span necessitated adopting a fixed frame structure in order to maintain the depth of slab within the narrow limits of the available headroom.

Concurrently with this work, the new harbour road was constructed in a deep cutting, the roadway passing over a reinforced concrete bridge spanning the deep cutting for rail access to the port side of the dock.

THE GRAVING DOCK EXCAVATION

Serious excavation on the dock site was not possible until a cofferdam had been provided to secure it from the inflow of water from Buffalo Harbour. This involved the driving of some 36,000 lineal feet of interlocking steel-sheet piling which was supported by mounds of rubble tipped on either side.

Early in 1944 the pile equipment was received. Two rigs mounted on barges were used. A fifty-foot frame equipped with a McKiernan-Terry hammer with short leg guides undertook the pitching and light partial driving. This was followed by a thirty-five foot frame equipped with a hammer with short leg guides, which drove the piles well into the rock in pairs. As the pile driving progressed, rubble mounds to sustain the piling against water pressure were tipped on both sides of the line of piling.

With the completion of the cofferdam, pumpinb commenced in October, 1944. After some twenty-four hours of pumping no appreciable difference in water level within the cofferdam could be noticed, and it was then suspected that seepage through the interlocking pile clutches was considerably greater than could be coped with.

This emergency was countered by gently shovelling quantities of stable manure against the piling on the seaward side. The small particles, in sinking, were drawn into the pile clutches and effectually sealed them off enabling the de-watering to be completed. So thoroughly was the cofferdam sealed that the seepage was always well within the capacity of one four-inch pump.

Excavation of the site to the required level was now possible, and two ten-hour shifts were introduced. A quarrying face was developed and by employing deep holes and setting the charges off electrically the excavation forged ahead. The excavated material was handled by excavators and loaded into tip trucks and dumpers operating on a ramp which graded down into the excavation area. After all local tips were filled, the tip trucks deposited their loads into rail trucks which were then hauled to the West Bank foreshore. Here the material was unloaded and bulldozed to form a level reclamation.

By February, 1945, the excavation had sufficiently progressed to enable a start to be made with the concrete work and by March a portion of the dock floor approximately 120 feet by 42 feet and 120 feet of sidewall were completed. This was required to enable an early start to be made on the erection of the caisson or dock gate.

CONCRETE WORK.

The progress of the concrete work was regulalated to keep pace with the excavation, the main difficulty encountered being the congestion of the site. There was barely room to fill the completed structures within the bounding of rail tracks and roadways. Elbow room for construction purposes was therefore nonexistent and for this reason it was decided to use a system of portable mixers from which the concrete was conveyed to the boxes by chutes and " elephants' trunks."

Crushed stone for the concrete work was accumulated in large stock piles on the west bank foreshore. The bulk of this stone was quarried and crushed on the west bank. A considerable amount of rock, from the excavation, which was suitable for crushing for concrete purposes was handled by a crusher near the job and discharged into a large stock pile from which fifty per cent. of the port sidewall and floor was constructed.

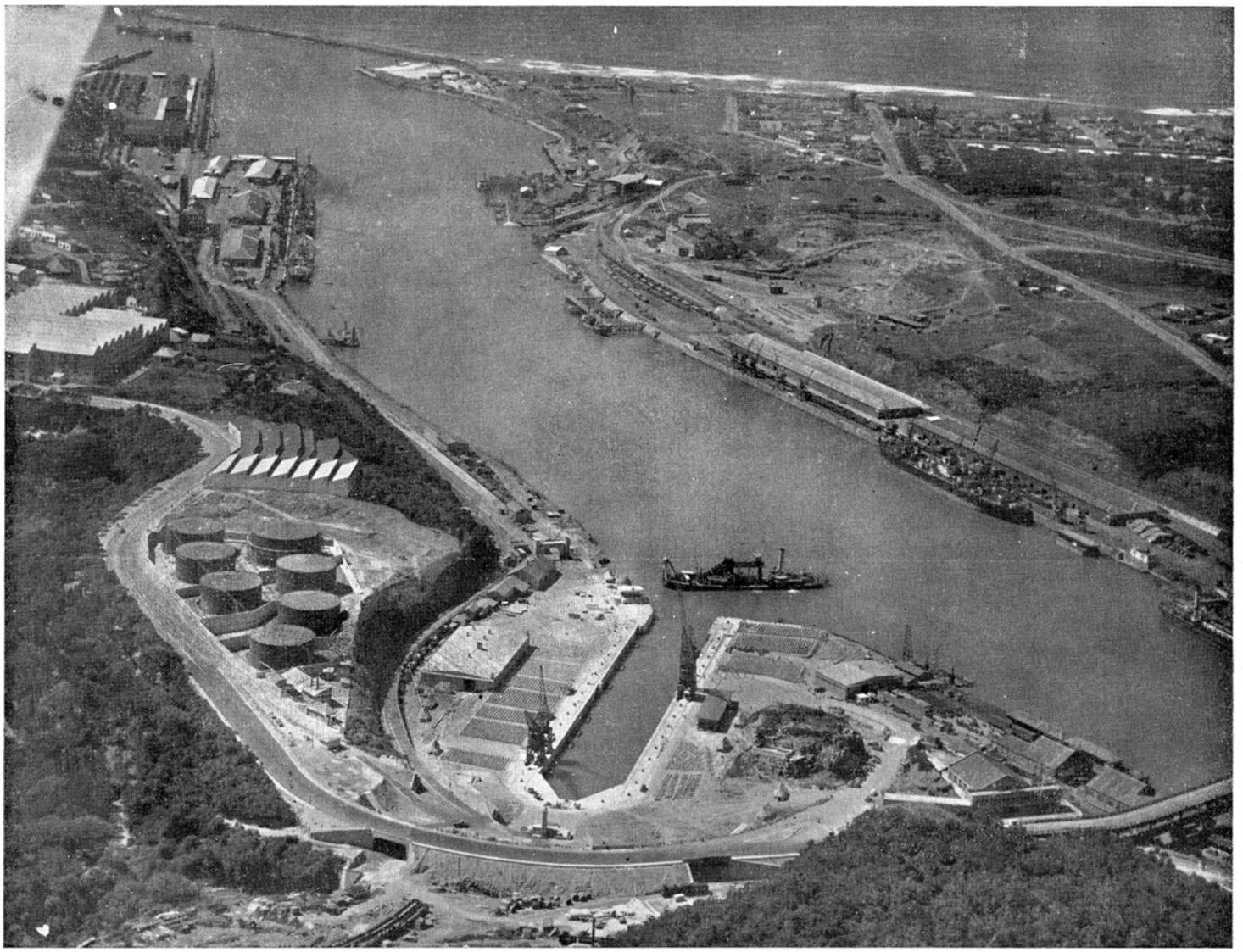
Sand for mass concrete was obtained from the West Bank Bight by bull-dozing at low water.

The entire surface of the work is finished with a skin, 12" thick of hard concrete. The sand for this purpose had to be imported from Brits and Uitenhage, as there are no deposits of suitable quartzitic sand in the East London area.

PUMPHOUSE.

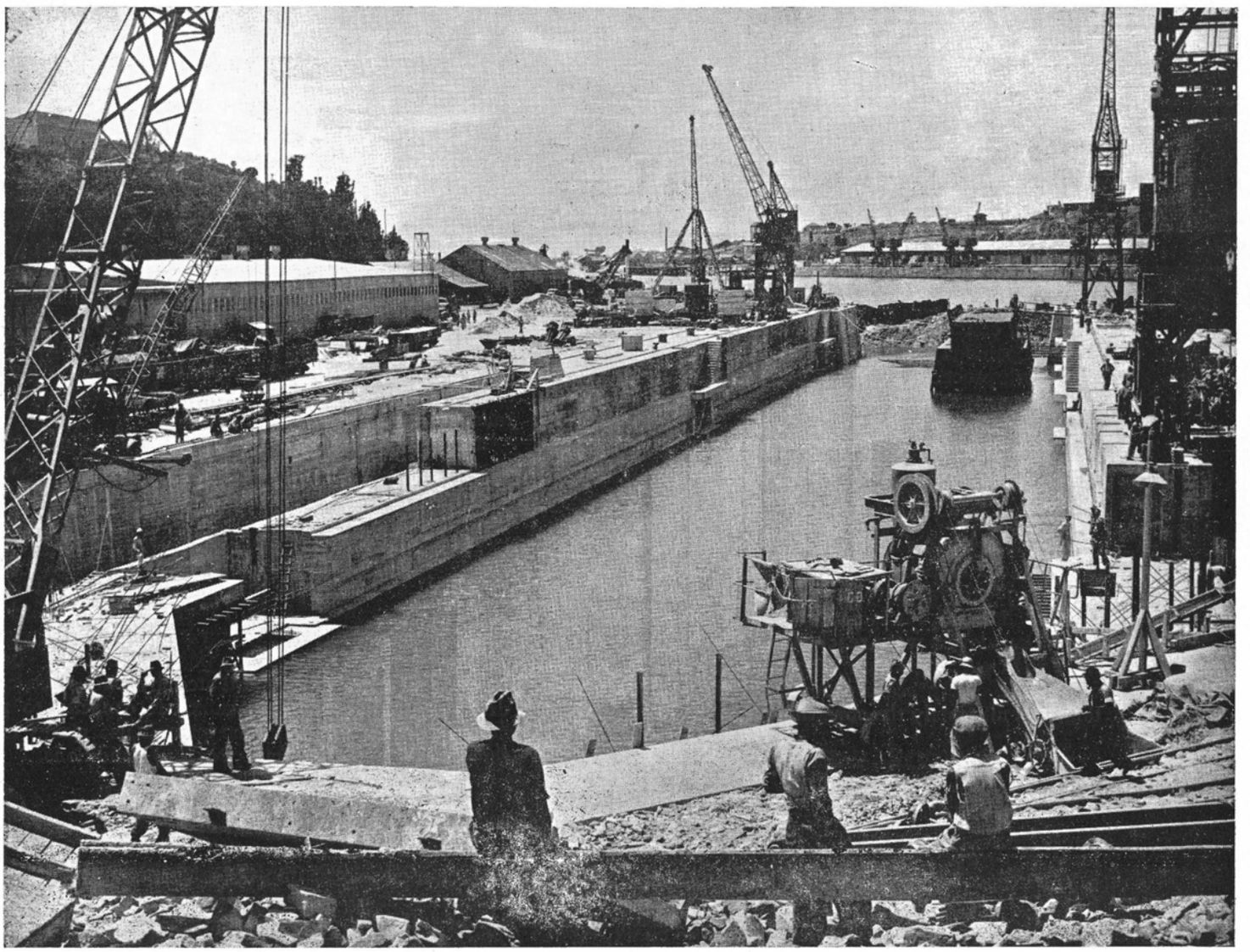
The excavation of the pumphouse site proved much more difficult than was anticipated. The pumphouse is situated right over the creek bed where it empties into the Buffalo River. This area had been filled in 1937 with rubble from the Turning Basin, which it was considered had settled down through the ooze creek bed and filled up from the bottom. Instead, it floated on the ooze which was contained by the steep sides of the creek and a bar of more compact material at the entrance. This resulted in the ooze being under pressure, and as soon as the excavation pierced the side of the creek, there resulted a large-scale mud squirt followed by an extensive settlement of the surrounding area.

It was realised then that retaining measures would be necessary to prevent the surrounding area from collapsing. The eastern boundary, which is also the east bank of the creek, was stabilised by driving steel-sheet piling into the rock and anchoring it back by tie-rods to the rock outcrop further back. The northern boundary, which crossed the creek diagonally, presented some difficulty. The depth, weight and saturation of the material to be retained would have necessitated at least two levels of anchorage for the



GENERAL AERIAL VIEW.

PHOTOGRAPH: S.A.R.



THE DOCK DURING CONSTRUCTION.

PHOTOGRAPH: S.A.R.

steel-sheet piling, and tie-rods of such length as to cause serious interference with the existing service sidings, etc. The only solution appeared to be a gravity retaining wall and this was accomplished by sinking seven sixteen foot by sixteen foot square concrete caissons to bedrock, after which they were filled with concrete and the stabilising effected.

This experience left doubt as to whether the southern boundary of the pumphouse, which also served as a retaining mound for the cofferdam, would maintain stability during excavation. It was decided to make doubly sure by constructing first that portion of the landing quay which abutted against the cofferdam. Steel-sheet pile shoring was accordingly driven round this area by a rig suspended from a crawler crane. Excavation by grab then followed. In order to meet the acute shortage of carpenters at this time, and to avoid delay, the usual timber shoring was dispensed with and at levels of approximately seven feet, a simple reinforced concrete slab was cast in rapid hardening concrete with two fifteen foot diameter octagonal openings for admitting the grabbing equipment. This work proceeded rapidly and the precaution in its undertaking was fully justified when it was found that the rubble merely overlaid the clay-silt material which extended to a depth of fifty-six feet into a veritable " hippo hole " (in which, in fact, hippo remains were found).

As frequently happens, this little surprise fell between the borings undertaken in the survey to ascertain the rock contours of the graving dock area.

Having excavated to rock, concrete was filled in, the retaining slabs being embedded in the concrete as the various levels were reached. The surrounding piles were then extracted and, with minor local shoring, it was possible to proceed unhindered with the excavation, and ultimately the construction of the pumphouse.

GENERAL CONSTRUCTION FEATURES.

The dock floor is founded on hard solid rock, and varies in thickness from four feet six inches to six feet. It was cast in blocks twenty-six feet seven and a half inches by thirty feet, and sixteen feet by thirty feet.

To prevent uplift action on the floor blocks, each block at foundation level is traversed longitudinally by a twelve inch by twelve inch drain filled with crushed stone, and by a cross drain, eighteen inches by eighteen inches, consisting of six-inch earthenware pipes, open jointed and bedded in crushed stone.

On the port side of the dock advantage was taken of the solid rock backing and the sidewall was kept to a minimum thickness. Maximum drainage from this rock backing was aimed at, and besides providing two weepholes per block per lift, watertight jointing between the blocks was omitted. The sidewall blocks were approximately thirty-five feet long.

On the starboard side, and round the fore end of the dock, it was considered necessary to provide a full gravity section and this portion has been sealed off against all seepage by providing bitumastic joints between the blocks.

The caisson grooves are lined with blocks of granite supplied and bedded by Messrs. Jamieson & MacFarlane of Paarl. These granite blocks are keyed into the concrete sill and sidewalls by a dovetailed filling of granolithic.

Formed in the sidewalls at the entrance, on either side at a level of twenty-four feet, are the four-foot diameter filling culverts. These each pass through a valve shaft in which is located a motor-operated four foot filling valve, which can be opend or closed in eight minutes and permits of the dock being flooded in one and three-quarter hours.

At a level of twenty-six feet below sea level the dock is encircled by a three-foot square culvert formed in the sidewalls and serving as the magazine flooding main, from which connection by way of six-inch pipes can be effected to docked warships.

Encircling the dock and built as a separate structure is the 5′ 6″ x 6′ ″ subway. This subway carries the electric cables supplying current to the pumphouse at service points in the dock cope, as well as power for the dockside cranes at plug points between the crane rails.

In addition the subway carries a four-inch compressed air main, a six inch saltwater main and a six inch fresh water main, service points being led out to the dock cope from these mains.

The pumphouse is situated on the starboard side of the dock at the entrance, in the angle formed by the starboard sidewall and the landing quay, and is an opening of approximately 15′ x 66′ surrounded by mass concrete which has been brought up from rock bottom in blocks. The pump chamber, being below ground level, is ventilated by two electrically driven axial-flow fans of sufficient capacity to prevent the temperature in the pumphouse rising more than 15° F. under normal working conditions.

PUMPING EQUIPMENT.

From the dockside drains the water flows by way of a six-foot diameter suction culvert through a six-foot diameter valve into the main sump at thirty-nine feet below sea level. From here the water is pumped by two thirty-six inch main pumps and discharged through a four-foot six-inch diameter discharge culvert.

A thirty-six-inch suction and a thirty-six inch discharge valve are installed fore and aft of each main pump. These valves are electrically operated, and in addition, the discharge valves are designed to close quickly and automatically when current fails — as when the main pumps stop.

The two main pumps are capable of emptying the dock within four hours, the quantity of water discharged being 63,000 tons (14,112,000 gallons).

Adjacent to, and forming portion of the main sump at a level of 45 feet below sea level, is the drainage sump. From this sump two 10″ drainage pumps are available for clearing the suction culvert and the main

and drainage sumps. Each pump is capable of delivering 750 tons of sea-water per hour. The drainage pumps are also required to pump from the pumphouse in the event of extensive flooding due to a damaged pump or any other cause, and two additional suctions are provided in the pumphouse for this purpose. An eighteen inch by-pass valve branches off from the 6′ diameter suction pipe just ahead of the 6″ diameter suction culvert valve from which an eighteen inch by-pass pipe has direct access to the main sump, This enables the normal drainage, when the dock is in use, to be dealt with by the drainage pumps.

In order to cope effectively with general seepage and leakage into the pumphouse, two 2½″ seepage pumps are provided in a 3′ 0″ deep recessed sump in the pumphouse floor. These pumps discharge into a common four inch main. Each seepage pump is capable of discharging thirty tons of sea-water per hour.

All pump motors are mounted on the operating floor, ten feet above the level of the pumphouse floor.

Owing to the humidity of a below ground level pumphouse, heaters are provided in each motor and item of control gear to raise the temperature above the ambient when the plant is not in operation.

The subway is terminated at the dock entrance on either side by a fire pump pit in which is housed a six-inch electrically operated centrifugal pump capable of pumping 150 tons of sea-water per hour and maintaining a pressure of 80 lb. per square inch in the six-inch salt-water fire mains.

CONTROL GEAR.

All the control gear for the pumping equipment and valves is mounted on the operating floor of the pumphouse.

The starters and resistances for the main pump motors are mounted adjacent to their respective motors, operating push buttons being conveniently mounted on each starter. Contacts are provided in each starter for operating the pump discharge valve and are arranged so that the valve is not opened until the pump has been run up to speed.

Limit switches are provided for all motor-driven valves to cut off current before the valve reaches the end of travel in either direction.

A valve starter board is provided on the operating floor of the pumphouse to control the two main pump suction valves, the six-foot suction culvert valve, the two external discharge culvert valves and the two main filling valves.

The board consists of an assembly of iron-clad panels, each containing a direct-on contactor starter with overload release in each phase and with common supply arrangements. On each panel is mounted a push button panel and two indicating lamps, coloured red and green respectively, to show whether the valve is open or closed.

The panels for the external valves are fitted with change-over switches for selecting control from the pumphouse, or local control from the valve pit, and in addition, arrangements are made for the two main filling valves to be operated from a dockside switch position.

SUB-STATIONS

Power for operating the pumphouse, and auxiliary services of the dock, is supplied by way of two sub-stations — port and starboard — situated approximately amidships of the dock and connected by branch subways to the main subway encircling the dock. As far as the dock services are concerned these sub-stations are duplicate units. The starboard substation is to be constructed in conjunction with the mechanical shops for the dock.

THE CAISSON.

The caisson is of the floating type, ninety-two feet four and three quarter inches overall length, to cope with a maximum beam of thirty-three feet two inches over fenders, a depth of forty-four feet from keel to cope, and a dead weight of approximately 1,260 tons. When light (with all tanks empty) it floats at a draught of twenty-six feet.

The caisson has five decks. The space between the bottom and the lowest deck forms a compartment into which is concreted 500 tons of ballast in the form of pig iron.

Mounted on the keelson, which is carried up to this deck by a diaphragm, is the twelve-foot six-inch diameter by sixty-four foot long water ballast tank by means of which this caisson is lowered into or raised out of the caisson groove.

The first deck also serves as a roadway for access from one side of the dock to the other when the caisson is submerged in the groove. The deck planking is fitted on top. This deck of planking serves as a foundation for the surface which consists of two and a half inch thick blocks of hardwood laid with end grain exposed.

The caisson was constructed by Messrs. Alpheus Williams & Dowse, Limited, on behalf of Messrs. Dorman Long & Co., Limited, and was completed in June, 1946.

DOCK CRANES.

Two travelling portable electric cranes, one on each side of the dock are provided. These cranes have a capacity of fifteen tons at a maximum radius of sixty-eight feet. There is also a five-ton travelling electric crane, which can be operated on either side of the dock.

CAPSTANS.

For warping ships into or out of the dock, three electric capstans are provided, one each on the starboard and port sides at the entrance and one at the fore-end of the dock.

These capstans are capable of exerting a pull of sixteen tons at forty feet per minute, change of direction of pull being easily effected by suitably-placed fairleads.

KEEL AND BILGE BLOCKS.

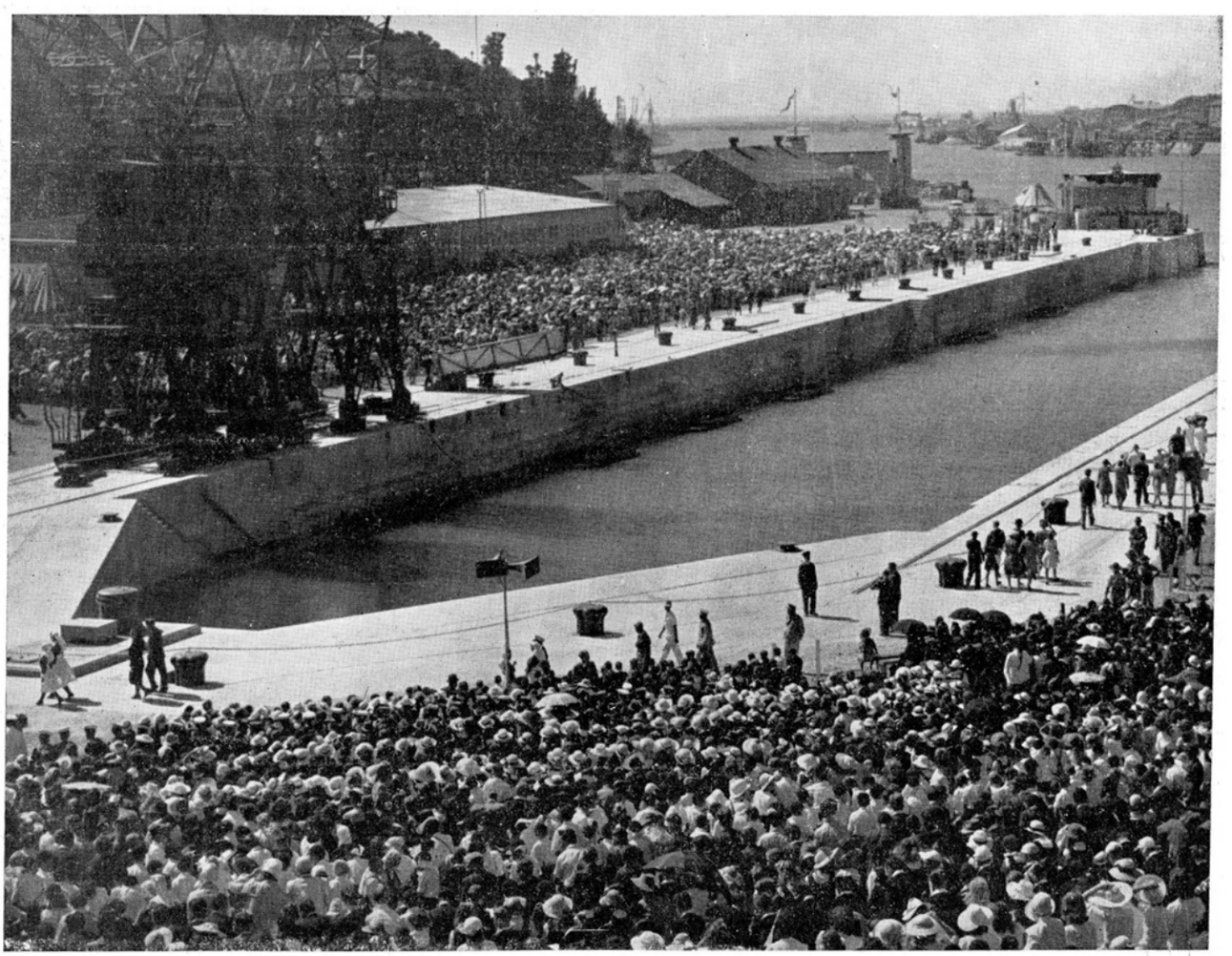
A middle line of keel blocks and two side lines of

bilge blocks are distributed over the dock floor. These absorbed some 1,939 tons of cast iron to manufacture, and they are capped by a total of 9,200 cubic feet of South African ironwood.

Flooding the dock commenced at the beginning of December, 1946, and the demolition of the cofferdam at the entrance was thereafter carried out with the aid of floating pile-extracting rigs and dredgers.

COMPARATIVE SIZES OF GRAVING DOCKS IN OTHER PARTS OF THE WORLD

Place.	Length Ft. in.	Breadth at Entrance Ft. in.	Depth on sill H.W.O.S.T. Ft. in.
East London (Princess Elizabeth Dock)	686 3	89 3	33 6
Cape Town (Sturrock)	1,181 0	148 0	45 9
(Robinson)	529 0	68 0	26 9
Durban (Prince Edward) ..	1,150 0	110 0	41 0
Hull	568 3	72 0	28 4
Newcastle-on-Tyne	711 0	90 0	29 0
Antwerp	726 6	85 3	28 6
Amsterdam	668 0	88 6	29 1
Marseilles	698 8	82 0	29 5
Brest	738 0	87 8	39 4
Melbourne	527 0	70 0	23 6



THE COMPLETED DOCK ON THE DAY OF OPENING.

PHOTOGRAPH: S.A.R.

THROUGH MOUNTAINS TO JOHANNESBURG

FOUR TUNNELS TO BE BUILT THROUGH THE HEX RIVER MOUNTAINS

ON Thursday afternoon, the 22nd of May, 1947, the Minister of Transport (Mr. Sturrock) detonated 40 charges of dynamite at the base of the Matroosberg in the Hex River Mountains to start the driving of the eight mile tunnel, which will replace the famous rail route over the pass, on the Johannesburg-Cape Town main-line. The present line winds up and down the precipitous passes of the Hex River Mountains, and while spectacular as an engineering feat, it has grave operational disadvantages. The scenery of the montains, however impressive, cannot compensate for the heavy punishment to which track, engines and rolling stock have to be subjected in order to negotiate this difficult section, and the decision to build the tunnel was announced in June, 1946.

The Hex River Mountains form a barrier between the brown and monotonous Karroo and the fertile green valleys and orchards of the De Doorns Valley. When the new tunnel is completed the railway passenger from the north will at one moment be travelling through the Karroo, but will emerge a few minutes later into the gardens of the Western Province. It will be like a stage-setting, with the curtain coming down for one scene and being lifted after a short interval to reveal a transformation far more spectacular than any impressario could produce.

The main tunnel, which will be eight miles long, will rank as one of the world's longest, while three secondary tunnels near De Doorns station and Osplaats Valley will consist of two of half-a-mile and one of two-thirds of a mile. By providing these tunnels the grade and curvature of the line will become easier, and higher train speeds over the sections will be possible. In fact, that railway bugbear, which train-men and operators know as "the mountain" will for them cease to exist, and full train loads will be hauled through the new line by single engines at full normal speeds.

The distance from Johannesburg to Cape Town will be shortened by four and two-thirds route miles, while the total length of the deviation will be about eighteen miles. The saving in curvature will amount to the elimination of thirteen complete circles, while rise and fall will be reduced by 475 feet.

The total cost of the work is estimated at £1,078,500 of which £620,000 is expected to be the cost of the main tunnel. Actual driving of the main tunnel should take about four years and the whole work should be completed in five years.

The Department of Geological Survey co-operated with the South African Railways in carrying out a general survey, but all other exploratory work was done by Railway Engineers.

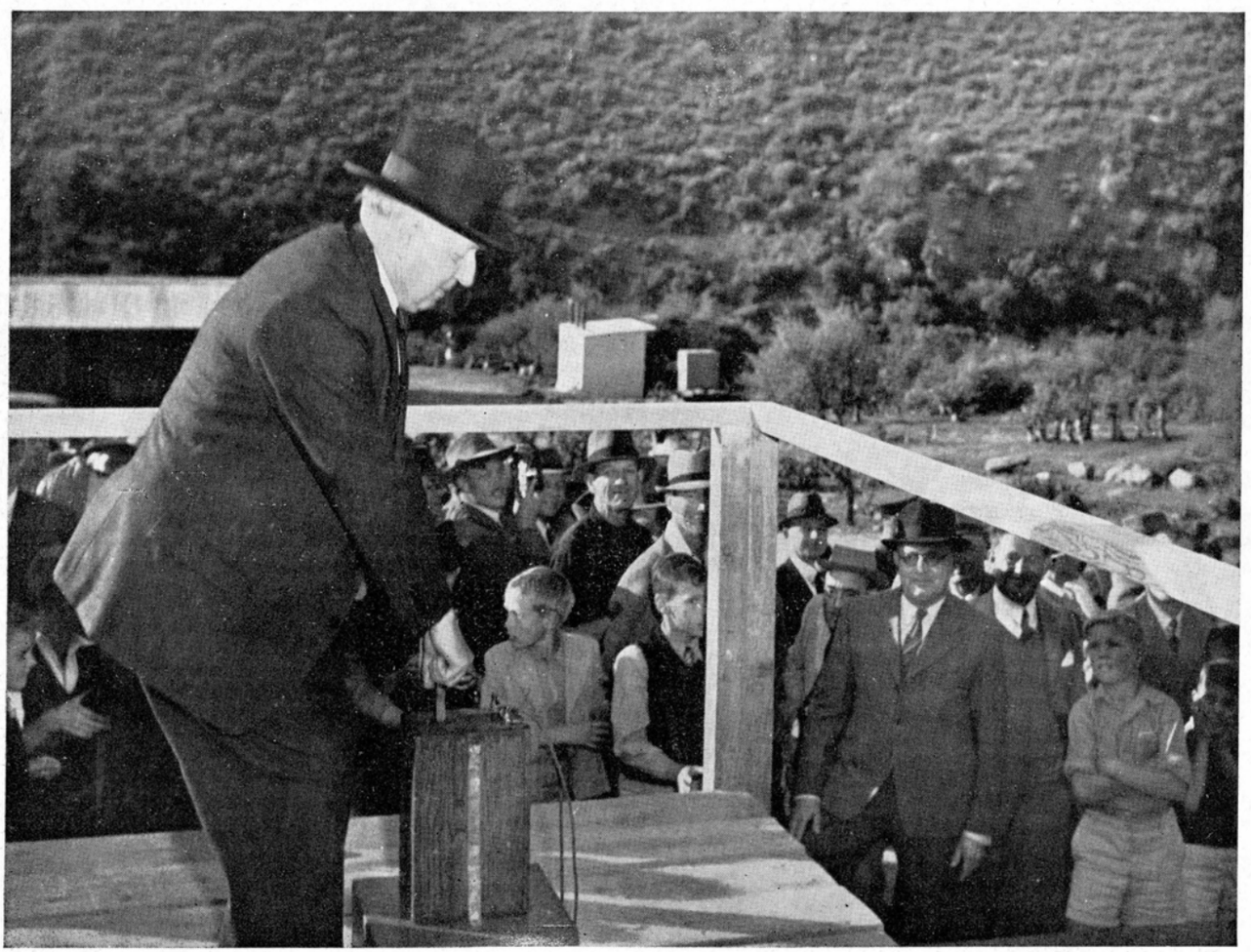
It was originally intended to spend £442,000 on improving the grade and curvature between De Doorns and Matroosberg by a route which still climbed over the top of the mountain, but since the new proposals will give much more satisfactory results from the point of view of both railways operating and train speed, it has been decided to deviate the line and to construct the required tunnels.

The decision to build the tunnels was made on economic grounds. At present all trains have to be dragged up to the top of the mountain and down the other side, and double-heading, which involves the stationing of banking engines and crews at De Doorns, for this sole purpose, is necessary.

TUNNELS IN OTHER PARTS OF THE WORLD

The longest tunnel in the world is the Simplon Tunnel of 12 miles, 560 yards, which runs from the little town of Brig in the Rhone Valley and emerges in Italy. It took 17 years to build. Other long tunnels are the Appennine Tunnel (11½ miles) between Bologna and Florence, which cost £8,000,000, and the St. Gothard Tunnel from Lake Lucerne in Switzerland to Lake Lugano on the Swiss-Italian border, 9¼ miles long, which took 10 years to complete.

The longest tunnel in Britain is the Severn Tunnel, which is 4 miles, 628 yards long.



PHOTOGRAPH: S.A.R.

THE MINISTER OF TRANSPORT DETONATES THE FIRST CHARGES.

The Appennine Tunnel was demolished by the Germans during their retreat in Italy and was restored by the South African Railway Construction Engineers, who were part of the Railways and Harbours Brigade. They also collaborated with units of the Mines Engineering Brigade on the building of the Cheka Tunnel, just under one mile in length, on the Levantine seaboard.

TUNNELS IN THE UNION

South Africa's longest tunnel at present is one of thirteen tunnels on the Amabele-Imvani section of the new railway from East London to Queenstown. Completed in 1945, it is known as the Cathcart or Hobbs Hill tunnel and is 3,202 feet long from portal to portal.

Work was started at the north end in August, 1942, and on the South end in June, 1943, in accordance with the practice of driving the tunnel from both ends. When it was "holed through" in May 1944, at a point 2,147 feet from the north end, the closing error in line was only ¼ of an inch.

More than 35,000 cubic yards of earth was removed in the construction of this tunnel and 6,775 cubic yards of concrete were used for the lining.

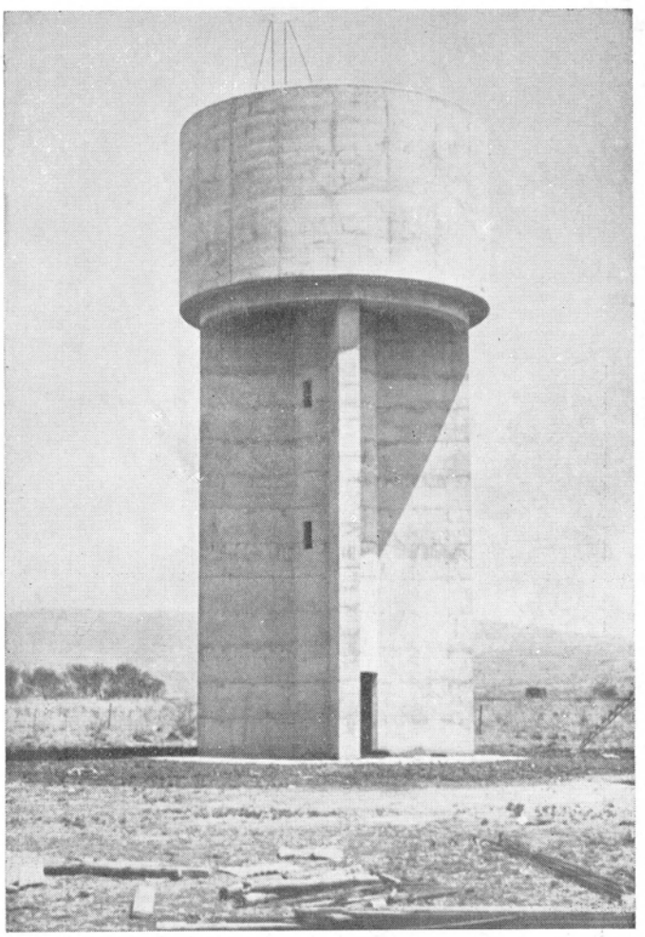
The Natal main-line over the Drakensberg Mountains has several long tunnels, including the Delville Tunnel (3,002 feet); the Shongweni Tunnel (2,986 feet); the Stockton Tunnel (2,793 feet); the Hilton Road Tunnel (2,728 feet); and the Laings Nek Tunnel (2,200 feet) which was completed in 1881.

PHOTOGRAPH: S.A.R.

THE START OF THE EIGHT MILE TUNNEL THROUGH THE MATROOSBERG.

THE KROONDAL WATER TOWER

NEW DESIGN FOR A WATER TOWER BY THE P.W.D. : :



PHOTOGRAPH: P. P. B. WILSON.

THE photograph shows a 30,000-gallon water tower erected in 1946 by the Public Works Department in connection with the water supply at the Tobacco Research Station, Kroondal, near Rustenburg, Transvaal.

The design of this tower incorporates a departure from the more usual form of independent column supports — a form of design which has given rise to the criticism that reinforced concrete water towers so often resemble concrete tanks on stilts. In this structure the supports consist of concrete walls in the form of a Maltese Cross, with an access shaft in the centre. These walls carry the circular beam and slab forming the floor of the tank.

The overall height is 48 feet and the diameter is 24 feet.

The tower is founded near the surface on a black turf subsoil, the weight being distributed through the reinforced concrete mat, so as to reduce the pressure to about one ton per square foot.

The aggregates for the concrete were proportioned by sieve analyses in the Public Works Department Laboratory, and no ingredients were added for water-proofing purposes. Steel shuttering was used for all external faces.

The Contractor, Mr. J. Zylstra of Pretoria, erected this tower as part of a major contract, which includes offices and laboratories on the same site.

Tenders Invited

THE following are particulars of the more important tenders which have been invited, up to the time of going to press, for Public Works by Government Departments, Provincial Administrations and Municipalities. In each case the date by which tenders must be submitted is given.

BUILDING TENDERS:

Somerset East: Construction of circulating water cooling pond (No. S.E. 2/1947). Extensions to Power Station Building and Plant Foundations (No. S.E. 3/1947). Town Clerk. Deposit £3-3-0 extra copies £1-0-0 each. Due 2/7/47.

Pinelands, Cape: Erection of extensions etc. to Conradie Home: Cape Provincial Tender Board: Provincial Secretary, Wale Street, Cape Town. Due 1/7/47.

Felixton, Natal: Erection and completion of new station buildings, waiting rooms, goods shed and light refreshment stall: Labour and materials: using unrestricted labour: Deposit £1-1-0. S.A.R. & H., Park Chambers, Johannesburg Due 10/7/47.

Prospect: Waterproofing of a reinforced concrete roof: Deposit £2-2-0: S.A.R. & H., Park Chambers, Johannesburg. Due 28/7/47.

STRUCTURAL STEEL WORK:

Structural Steel Work: S.A.R. & H., Park Chambers, Johannesburg. No. 6809. Due 24/7/47.

ELECTRICAL INSTALLATIONS, EQUIPMENT, MATERIALS AND LIFTS:

S.A.R. & H., Park Chambers, Johannesburg: Signalling material (electrical): No. 6748: Due 24/7/47.

Public Works Department, Pretoria: Electric Service Lift: Supply, delivery and erection of one electric service lift at Mineral Research Laboratory, Johannesburg: P.W.D. No. 811: Due 3/7/47.

Uitenhage: Electrical Engineer. Sundry electrical material: Contract E/21: Due 30/6/47.

Shabani, Southern Rhodesia: Electricity Supply Commission: Supply, delivery and erection of circulating water piping and spray cooling plant at the Commission's Shabani generating station. Contract 53/1947. Deposit £5-0-0, extra copies of documents at 5/- each (The Secretary). Due 29/7/47.

S.A.R. & H., Park Chambers, Johannesburg: Train lighting equipment, cells and generators. No 6655. Due 17/7/47.

Electricity Supply Commission: Electricity House, Cape Town (The Manager). Insulators. Specification 220/1947. Due 8/8/47.

Keetmanshoop Municipality: Supply delivery and in certain sections, the erection of the following plant and equipment:—

Section A. 6.6 K.V. and L.T. power station switch gear and sundries.
Section B. 6.6 K.V. and L.T. cables, laying, jointing, etc.
Section C. 6.6 K.V. overhead line materials and construction.
Section D. 6.6 K.V. and L.T. sub-station equipment.
Section E. Transformers.
Section F. Indoor and outdoor house services.
Section G. Motors and Starters.
Section H. Replacement of D.C. equipment, radios, refrigerator motors, fans and sundries.

Specification K.R.1/1947. One copy of contract documents on deposit of £3-3-0, extra copies at £1-0-0 each. Consulting Engineer: J. S. Clinton, P.O. Box 4648, Johannesburg. Due 14/7/47.

S.A.R. & H., Park Chambers, Johannesburg: Electrical signalling materials. No. 6379. Due 14/8/47.

S.A.R. & H., Park Chambers, Johannesburg: Telegraph line materials. No. 6680. Due 14/8/47.

Department of Posts and Telegraphs, Pretoria: Distribution boxes and lightning protectors. P.O. 787. Due 26/6/47.

Natal Provincial Tender Board: P.O. Box 358, Pietermaritzburg. Lifts in surgical block, Addington Hospital. Provincial Works Office, Pietermaritzburg. Due 30/7/47.

Bulawayo Municipality: Town Clerk. Switch gear, transformers, insulators, variable speed couplings, lightning arrestors, tubular steel poles, meters, underground cables and auxiliary equipment, overhead line equipment. Contract E.35/1947. Offers ex-export and ex-Rhodesian or Union stocks are required, the last named in preference. Deposit on documents £1-1-0, additional copies of documents at 10/6 each. Due 15/9/47.

Matatiele Municipality: Town Clerk. Electrical equipment:

(a) Supply and installation of two sets of Diesel engines and alternator, 125 k.v.a., 3-phase, 4-wire, 400/230 volts, .8 power factor, not exceeding 600 r.p.m.
(b) Supply and installation of one set of Diesel engine and alternator, 50 k.v.a., 3-phase, 4-wire, 400/230 volts, .8 power factor, not exceeding 750 r.p.m.
(c) Materials for alterations to distribution.
(d) A.C. meters.
(e) Necessary switch board instruments for the above installation.
(f) Various household equipment and motors, i.e. refrigerator motors, 3-phase motor fans, wireless sets. etc. Deposit £3-3-0. Due 25/8/47.

Pretoria Municipality: City Electrical Engineer. Overhead electrical travelling crane. No 604. Extended to 15/7/47.

Uitenhage Municipality: Electrical Engineer. Electric cables and joints. Contract E/22. Due 31/7/47.

P.W.D., Pretoria: Fluorescent fittings. P.W.D/S.91. Due 3/7/47.

P.W.D., Pretoria: Electrical material. P.W.D./S.70. Due 10/7/47.

Pietermaritzburg: City Electrical Engineer. Electrical installation in 100 cottages at the Native village, Mountain Rise. Contract 235. Due 23/6/47.

White River: Town Clerk. Distribution material. W.R.1/1947. Extended 2/7/47.

Johannesburg: Stores Department:
Bare copper conductor. Contract 125. Due 22/7/47.
Direct current switchboard. Contract 126. Due 22/7/47.
Distribution Transformers. Contract 127. Due 15/8/47.

WATER SUPPLIES, PUMPS, PIPING & WATER WORKS:

Swellendam Municipality: Augmentation of water supply. Pipes, valves, special fittings and jointing material. Contract 3/1947. Deposit £2-0-0 for two copies of documents. Consulting Engineer: Ninhan Shand, 606, Groot Kerk Building, Cape Town. Due 25/6/47.

Postmasburg Municipality:..Water supply undertaking. Erection and completion of the following:
Section D. Trenching and pipe laying only.
Section E. Pumphouses.
Section F. Reservoirs.
Section G. Work in consumers' houses.
One copy of contract documents on deposit of £2-2-0; extra copies £1-1-0 each. Consulting Engineer: L. S. Richfield, P.O. Box 817, Johannesburg. Due 21/6/47.

Fish Hoek Municipality: Water Supply Scheme. Spun iron or asbestos cement pipes, specials valves, fittings and jointing material. Contract 8/1947. Deposit £2-2-0. Consulting Engineer: Ninhan Shand, 806 Groot Kerk Building, Cape Town. Due 31/7/47.

Pietermaritzburg Municipality: City Engineer. Henley pipe line: Main aqueduct.
1. Sluice and air valves. Contract 8/1947.
2. Steel pipes and specials. Contract 9/1947.
Due 1/9/47.

Pietermaritzburg Municipality: City Engineer. Supply and installation of pumps, motors and pressure tank at the Oribi Reservoir. Contract 14/1947. Due 23/6/47.

Harrismith Municipality: Water Scheme:
Section 1. Chemical plant and rapid gravity filtration plant.
Section 2. Flash mixing plant, flocculating plant and sludge removal equipment for settling tank.
Section 3. Pumping plant.
Section 4. Transformers, H.T. and L.T. switch gear and cable connectors.
Contract 3/1947. Consultant Engineers: Stewart, Sviridov and Oliver, 66, Commissioner Street, Johannesburg. Due 18/7/47.

Johannesburg Municipality: Stores Dept. Hot water meters. Contract No. 118. Due 19/7/47.

SEWERAGE INSTALLATIONS, ETC.

Cape Provincial Tender Board, Cape Town: Supply and installation of new sewage pumps, motors and fittings, at the pump house in connection with the recontsruction of the sewerage system at the Conradie Home, Pinelands, Deposit £2-2-0. Contract No. 27/1946. Consulting Engineer: Ninhan Shand, 806, Groot Kerk Buildings, Cape Town. Due 24/6/47.

Cape Town (City Engineer): New disposal works at Athlone. Four sewage distributors complete with sprink.er arms, pipes, bends, etc. Form of tender C.A./1/47. Due 31/7/47.

Cape Town (City Engineer): Supply and erection of mechanical equipment comprising sludge pumps, sludge removal device and flocculating equipement required to be installed within two concrete humus taks which will be provided by the Council. Due 31/7/47.

Johannesburg: City Engineer. Labour and materials for the sewerage reticulation of portion of South-Eastern Orlando East. Deposit £1-1-0. Contract 1870. Due 23/6/47.

MISCELLANEOUS:

Department of Posts and Telegraphs, Pretoria: Extra receivers for telephones. P.O. No 782. Due 19/6/47.

S.A.R. & H., Park Chambers, Johannesburg: Hardwood for bridge timbers. No. 6374. Due 19/6/47.

Department of Posts and Telegraphs, Pretoria: Steel private boxes. P.O. 785. Due 17/7/47.

City Electrical Engineer and Transport Dept, Pietermaritzburg: Omnibuses: 12 single and double-decker. Contract 228. Three copies of documents free of charge; additional copies at 5/- each. Due 21/8/47.

City Electrical Engineer, Pietermaritzburg: Crematorium Furnace. Contract 234. Three copies of specification on application; extra copies at 5/- each. Due 21/8/47.

Stores Department, Johannesburg: Tractors. Contract 96. Due 21/6/47.

Stores Department, Johannesburg: Radio telephone communication equipment. Contract 98. Due 9/7/47.

Stores Department, Durban: Omnibuses. 25 double-decker motor omnibuses. S.2694. Due 5/9/47.

Stores Department, Durban: Omnibuses. 50 double-decker motor omnibuses. S.2695. Due 5/9/47.

Stores Department, Johannesburg: Linoleum. Contract No. 101. Due 21/6/47.

S.A.R. & H., Park Chambers, Johannesburg: Boiler and superheater flue tubes. No. 6753. Due 10/7/47.

S.A.R. & H., Park Chambers, Johannesburg: Cast steel friction draw gear. No 6838. Due 3/7/47.

S.A.R. & H., Park Chambers, Johannesburg: Steel axles and tyres. No. 6747 Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Antimony. No. 6807. Due 10/7/47.
Stores Department, Johannesburg: Stand number plates. Contract 111. Due 21/6/47.
Stores Department, Johannesburg: Sanding machines. Contract 112. Due 22/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Vertical spindle surface grinder. No. 6650. Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Spring load deflecting test machine. No. 6712. Due 17/4/47.
S.A.R. & H., Park Chambers, Johannesburg: 15 cwt. Steam Hammer. No. 6711. Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Combination spring plate machine. No. 6713. Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Open throat or skew gap bar and billet shear. No. 6784. Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Spring scragging machine. No. 6785. Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Hydraulic press. No. 6786. Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: I.R. parts and drawgear springs. No. 6769. Due 17/7/47.

Union Tender and Supplies Board, P.O. Box 371, Pretoria: Microscope to Director of Veterinary Services, Onderstepoort. No. S.O. 1327. Due 26/6/47.
Union Tender and Supplies Board, P.O. Box 371, Pretoria: Microscopes to Director of Geological Survey, Dept of Mines. No. S.O. 1374. Due 26/6/47.
Government Printer, Pretoria: Printers and book-binding requisites. G.P.W. 78. Due 24/7/47.
Department of Posts and Telegraphs, Pretoria: Rope. P.O. 786. Due 19/6/47.
S.A.R. & H., Park Chambers, Johannesburg: Brake and clutch linings for motor vehicles. No. 6800. Due 17/7/47.
S.A.R. & H., Park Chambers, Johannesburg: Vacuum steam pressure guages. No. 6368. Extended, now due 26/6/47.
S.A.R. & H., Park Chambers, Johannesburg: Lathes. No. 6658 and No. 6625. Extended, now due 19/6/47.
Department of Posts and Telegraphs, Pretoria: Engraving machine. No. P.O. 788. Due 24/7/47.
Department of Posts and Telegraphs, Pretoria: Spindles, malleable cast iron. No. P.O. 790. Due 26/6/47.
Union Tender and Supplies Board, P.O. Box 371, Pretoria: Chemicals to Director of Veterinary Services. S.O. 1409. Due 14/8/47.

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