Construction of the Prieska–Kalkfontein railway line 1914–15

Part 2: A major obstacle – the Orange River at Upington

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One hundred years ago South Africa, as part of the British Empire, was at war with Germany. The first objective of the Union Defence Force was to take control of German South-West Africa (GSWA, today Namibia). A part of this offensive was to bridge the gap between the two national railway systems, from Prieska in South Africa to Kalkfontein (today Karasburg) in GSWA. This was a daunting challenge delegated to a newly formed South African Railways (SAR) and was executed successfully under trying conditions. This article (part two of three) describes the bridging, within five months, of the formidable Orange River at Upington. The first article in this series appeared on pages 50–63 in the March 2015 edition of *Civil Engineering.*

THE LINE MUST MARCH ON …

When Parliament sanctioned the railway line from Prieska to Upington, the endpoint of the line was precisely defined: "… the town of Upington is situated on the north side of the Orange River, and I [Engineer-in-Chief William Tippett] have, therefore, considered it out of the question to carry the railway into the town as this would necessitate the erection of a very costly bridge. The proposal is to bring the line in a direction suitable for the ultimate erection of a bridge across the Orange River, but to bend it round temporarily to a station site as near as possible to Upington on the south side of the river."

The town of Upington was therefore fixed as the main launching pad for the overland invasion of German South-West Africa (GSWA) to support the Union forces landed by sea at Lüderitz and Walvis Bay. But Upington is still 277 km from the German railhead at Kalkfontein – a formidable gap remaining across dry, barren country. Sir Thomas Price, the chairman of the Railway Board controlling the construction of new lines, wisely anticipated that the line soon would have to be continued from Upington and convinced the Railway Board to make provisional arrangements. On 29 September, General Manager Hoy was authorised to continue the survey from Upington onwards to GSWA, and Price undertook to get Cabinet approval for the construction of a temporary bridge over the Orange River at Upington. Two days later Price reported that Cabinet would like the Board to proceed with the bridge "as early as possible". There was some initial uncertainty whether the extension would be a regular railway line or a "defence line". All costs beyond the original terminus were therefore booked on a separate account. On 11 December, General Smuts assured Price personally that these funds would be reimbursed by the Department of Defence.

Although Cabinet approved the crossing of the Orange River on 1 October, it was not made public immediately. On 2 October, for example, the Town Council of Upington enquired from the Railway Board whether a bridge was to be built over the Orange River. (The Town Council had earlier applied for a government loan to erect a municipal pontoon over the Orange River, as the existing one belonged to a private operator. If the bridge was to be built, the need for a municipal pontoon would obviously fall away and the Town Council could withdraw their loan application.) On 15 October, the Railway Board responded evasively: "... at the moment it is not possible to give any definite intimation as to whether it is the intention to construct a bridge across the Orange River at Upington, but I am to suggest that your Council should allow the question of a loan from Government for the purpose of erecting a pontoon to remain in abeyance for a month."

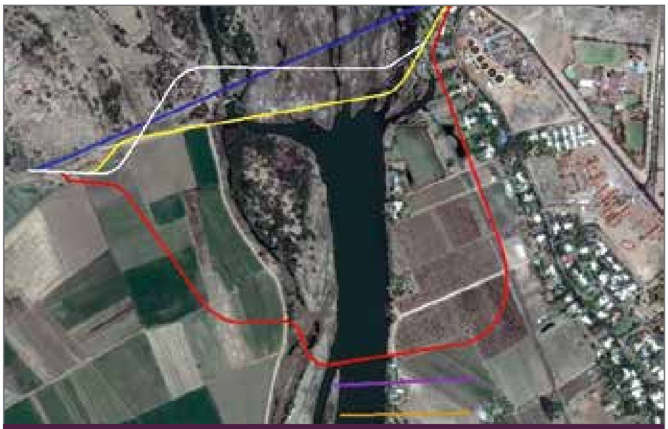

Figure 2: The crossing positions used at Upington: temporary low-level bridge (white), permanent low-level bridge (yellow), permanent high-level bridge (blue, built in 1934), train ferry (red), military pontoons (purple), boats (orange)

Figure 1: The pontoon at Upington taking a load across at its original position, with one of the rowing boats in the foreground (Transnet Heritage Library photograph 18609)

Figure 3: A photograph of the Orange River in flood, taken after 1934; the permanent high-level bridge and the footings of the permanent low-level bridge are clearly visible (Transnet Heritage Library photograph P2427)

The reason for this deliberate misrepresentation was probably connected to the declaration of martial law on 15 October, prompted by the Rebellion which then had broken out in a few different areas. Under martial law, alternative and speedier channels of approval could be used. After 15 October there was no need for further secrecy, and bridge construction started before October was out. Resident Engineer Prettejohn was instructed by Engineer-in-Chief Tippett on 5 November to provide temporary sidings on the south bank of the Orange River for the stockpiling of track material required for the construction of the line beyond Upington. On 11 November, General Manager Hoy confirmed the urgency of building a stockpile of track material at Upington to "minimise the possibility of delay to construction work beyond Upington owing to the shortage of material". The preparation of the line to GSWA was thus firmly under way by the middle of November. So when the weary construction team, all the way from Prieska, reached Upington on 20 November, their instructions were waiting for the next, even more demanding stretch to Kalkfontein. But first, the Orange River had to be crossed.

CROSSING THE RIVER BY PONTOON

Before the war, the Orange River at Upington could only be crossed by pontoon, operated by a local concessionaire. As more goods had to be moved across the river due to wartime needs, it was soon "found quite unequal to the traffic". Moreover, the southern approach to the old pontoon was compromised during the flood period on account of flooded channels running parallel to the main stream. The SAR had to improve the existing arrangement and Assistant Engineer James Merriman Greathead, who later supervised the construction of the train ferry and bridges discussed in the rest of this part, was put in charge. He reported to Resident Engineer-in-Charge Nicholas Prettejohn and Bridge Engineer James Mackenzie. Greathead made a number of improvements:

- Two ordinary pontoons, "such as are in common use on South African rivers", were installed for military purposes, each capable of carrying 15.2 metric tonnes.
- To ferry passengers and smaller goods, four large motor boats and ten large rowing boats were placed on the river alongside the pontoons.
- The point of crossing the river (roughly opposite the current CBD of Upington) was moved to a more favourable position 2.4 km above Upington, where there was one wide main channel and a small subsidiary channel.
- The rail was extended on the south bank from the end of the railhead to the point of crossing, including a siding of about 914 m in length, and a trestle bridge 46 m long and 6.1 m high across the subsidiary channel (since filled in).

The two 15.2 tonne pontoons were built in Durban and transported to Upington with great haste. They left Durban on 23 November with the instruction that the pontoons were "very urgently required and continuous transit to be arranged if practicable" and that "all examining centres should be instructed [to] adjust lashing if necessary." The pontoons constituted a large load, 3.0 m wide at the top and 3.5 m above rail. General Manager Hoy followed its progress through Newcastle (24 November), Johannesburg (25 November), Klerksdorp (26 November) and Kimberley (27 November). Once on site, the public of Upington naturally also wished to use the new pontoons to cross the river, but permission was denied "while

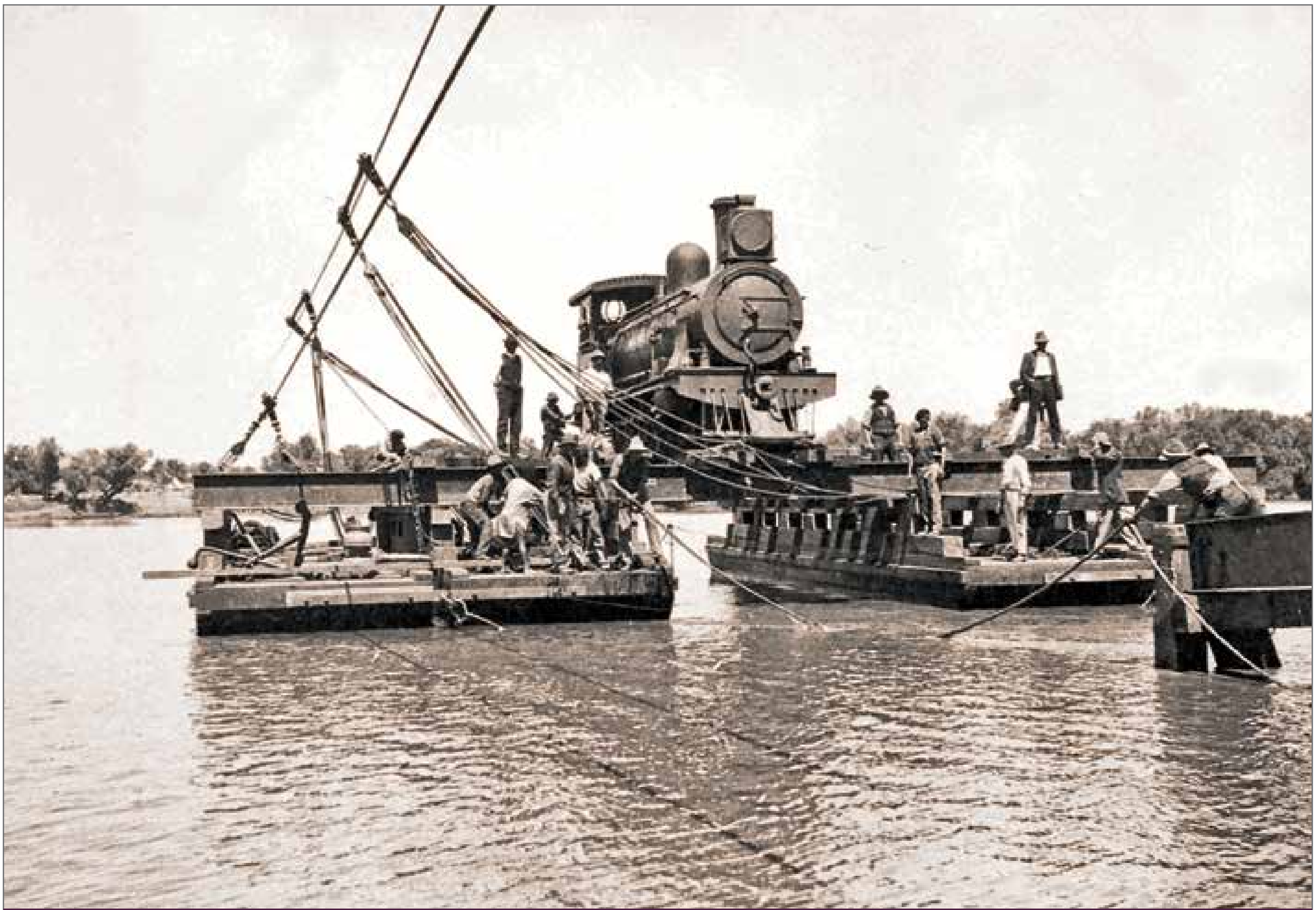

Figure 4: The train ferry approaching the north bank, showing the guide cabling (Transnet Heritage Library photograph 49505)

Figure 5: The first locomotive to cross the river is mounted on the cradle as it is lowered down the slipway of the southern pier; the photograph was taken on 14 March 1915 (Transnet Heritage Library photograph 49503)

military operations are in progress" and they continued to use the old pontoon. Figure 1 shows one of the pontoons crossing the Orange River.

THE TEMPORARY BRIDGE – FIRST ATTEMPT

The pontoons had a weight limit of 15.2 metric tonnes which could not be exceeded. But a locomotive weighed 44.7 metric tonnes, and ordinary rail trucks loaded with rails or sleepers had a gross weight of about 35.6 metric tonnes. To get rolling stock across the river, something more substantial had to be devised. An obvious answer was to construct a temporary railway bridge: "This was to be at low level, and it was hoped that as the usual time for floods was not sooner than January, traffic might be run over that bridge for six or eight weeks before it was submerged, and that thus it might have been possible to take over large quantities of supplies, including rolling stock and material for building the railway to the border."

The Orange River at Upington is intersected by a large dolerite outcrop, shown in Figures 2 and 3. The SAR engineers capitalised on this outcrop to break the crossing into a series of numerous small bridges. By early November, the work on the temporary bridge "across the then narrow stream, with subsidiary openings at some of the larger flood-channels", started.

The hopes for a flood-free window of opportunity, however, were soon dashed. By the middle of November: "... exceptionally heavy rains fell in the Transvaal, Orange Free State and Northern Cape Colony, and as all this huge area drains into the Orange River it very soon rose at Upington from being a stream of about 152 m wide and 0.6 m deep to being nearly 1.6 km wide, 4.6 m deep and flowing at a velocity of 2.7 m/s – the latter considered to be high for a large river."

The flood surge arrived at Upington on 1 December, the river described as a "raging torrent a mile in width" which abruptly stopped construction. The flooding continued during early summer. "On several occasions there were 4.9 to 5.4 m of flood water in the river, and no sooner did it drop sufficiently to permit operations being resumed than the river came down again in heavy flood." It would be three long, frustrating months before the engineers could resume their work. See Figure 8 for the water levels during this period.

THE TRAIN FERRY

The need to get heavier rolling stock across the river for the continuation of the railway to Kalkfontein became more urgent by the day as the military build-up for the GSWA campaign continued. As the work on the temporary bridge had to be suspended due to flooding, an idea was hatched at the beginning of January 1915 to build a train ferry capable of transferring locomotives and a regular supply of track materials in trucks to the north bank. It was anticipated that such a ferry could transfer 20 trucks every 24 hours, with "empties" returned at night. The necessary material and equipment were ordered forthwith. The train ferry was to be installed alongside the existing pontoons where the main river channel, at that time, was 335 m wide.

The train ferry itself floated on four wooden pontoons, specially built in Cape Town. Each pontoon was 14 m long, 2.7 m wide and 1.4 m in depth – a size convenient for rail transport. On arrival at the south bank they were separately launched before connected in pairs. A platform, built in Durban and sent by rail to Upington in sections, formed the superstructure of the ferry.

The platform was formed by steel I-beams at right angles to the direction of travel, connected by jarrah timbers laid longitudinally. Rails at standard gauge were laid on top. The platform on its own weighed 17 tonnes. (The original idea was to transfer the platform from the bank onto the pontoons at every crossing, but it proved too difficult and the platform was eventually permanently fixed onto the pontoons.) The ferry was guided on its way across the river by two heavy wire cables, 32 mm in diameter. The cables spanned 402 m across the river, with a dip of 6.1 m, from 6.1 m tall masts on both ends, properly strutted and guyed. The ferry was connected to the cables by means of six tackles – from ringbolts on the deck of the ferry to carriers travelling on the cables. A second set of cables were used for hauling the ferry to and fro, connected to a ring on either end of the nose of the upstream pair of pontoons. The train ferry with its guiding cables is shown in Figure 4.

It was a major civil engineering undertaking to construct slipways on both banks, extending far enough into the river to ensure adequate water depth at the end pier to float the ferry. The southern slipway (the two slipways were roughly similar), originally planned for a gradient of 1:8, was eventually built at a gradient of 1:19 over a distance of 47 m, later extended by another 18 m at 1:27 when the water level dropped. The slipways were built on about 60 timber piles running out into the river like inclined jetties. The top structures of the slipways were constructed with steel I-beams. (The beams were conveniently already on site, ordered and waiting for the construction of the permanent bridge, and "borrowed" for the train ferry during the flood period.) For each slipway, a cradle was designed to provide a level top as it ran up and down the slipway on rails at 10 feet gauge. Pile-driving for the slipway started on the south bank by the middle of January until complete, and then continued from the north bank.

River hydraulics continued to harass the project, in three ways. First, the fluctuating river level slowed down the piling as the pile-driving equipment had to be moved up and down the river bank as it followed the water level (there was not enough time to build coffer dams around the areas to be piled). Second, the required length of the slipways depended on the river level, causing frequent design and construction changes. Third, the heavy silt load in the river dropped out at the ends of the slipways, compromising the depth required for the ferry. Pumps had to be permanently run to maintain enough turbulence at these critical points to prevent sedimentation.

The operation of the train ferry involved a number of critical steps. For a locomotive crossing from south to north (the locomotive boiler emptied first to avoid surging from end to end), the cradle on the southern bank was drawn to the top of the slipway and fished to the end of the regular rail. After the dead locomotive was shunted onto the cradle, the connecting fishplates were removed and the cradle lowered until the rails on the cradle aligned with those on the ferry. The ferry was then steadied by jacks on the pier to counter the sinking of the ferry and the rails of the ferry and the cradle fished together. Then came a delicate

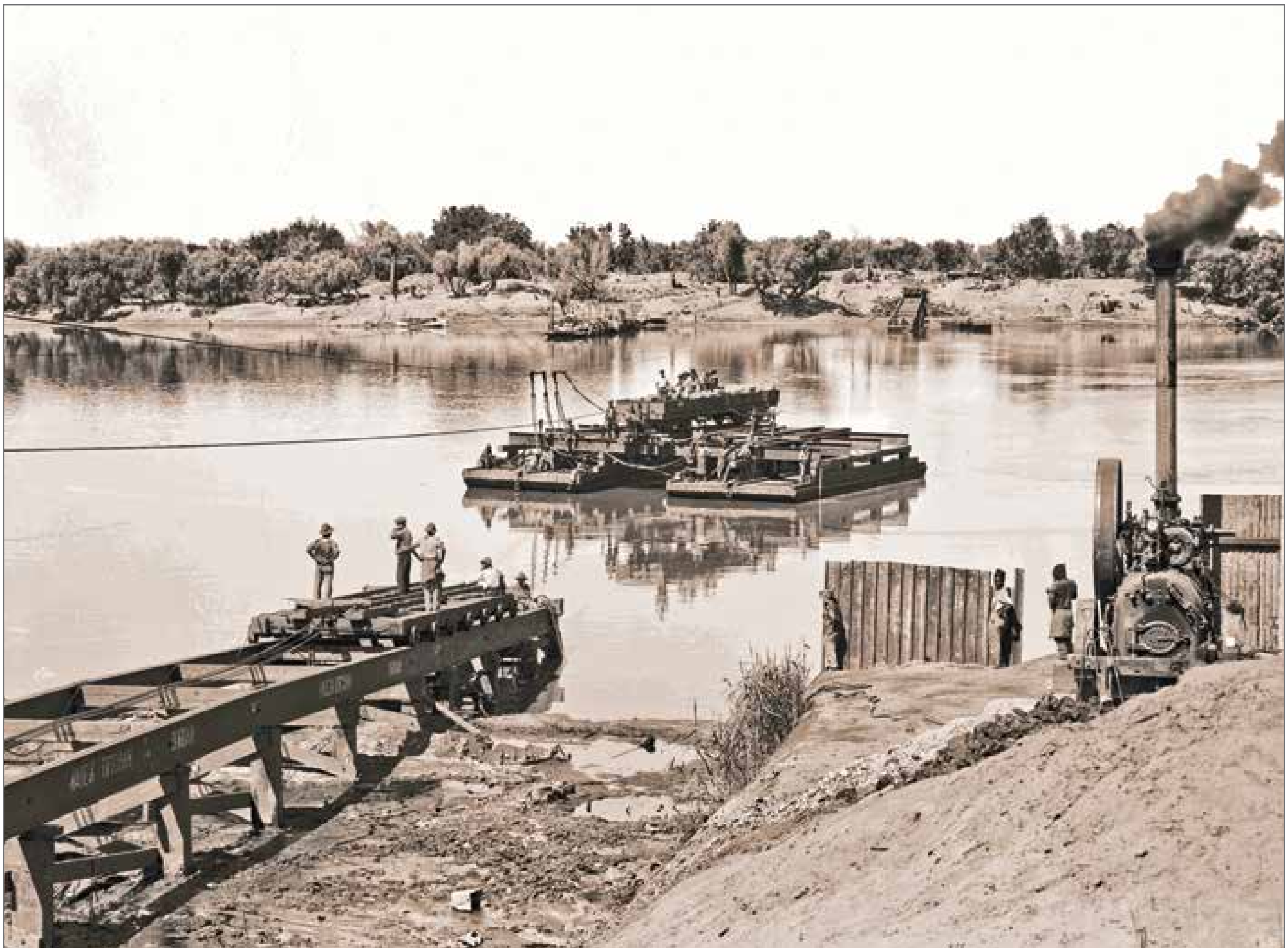

Figure 6: The train ferry with a truck is awaited at the northern pier; this photograph was taken on 16 April 1915, the last day of the train ferry being in operation (*South African Railways and Harbours Magazine*, June 1915, p 530)

manoeuvre: “The engine is run off the cradle onto the pont which dips her nose well into the water, while her shoreward end is firmly supported by the jacks. The engine is scotched in position as soon as its centre of gravity comes to the centre of the pont and the connecting fishplates are removed. The shoreward end is jacked down until the pont rests upon an even keel.”

After the ferry was hauled across to the north bank, the rails of the ferry were fished to the cradle rails once more, but this time steadied by chaining it down onto the pier to prevent it from popping up as the locomotive weight is removed. The hauling of the cradles up and down the slipways, and the hauling of the ferry across the river were done with steam-driven winding engines. Using this procedure, it took about two hours to take a locomotive across and 30 minutes for an ordinary rail truck loaded with rails or sleepers. Once a rhythm was established, the actual trip over the water occupied only about four minutes, but the careful loading and unloading took considerably longer. “The best day’s work performed was the transfer of 24 loaded trucks in the day shift … followed by the return of 16 empties during the night.”

The train ferry was completed on 14 March 1915 and put into operation without delay. The first engine to cross was No 1042 7th Class with driver Van Rensburg. A week later, on 21 March, a second locomotive (No 972 7th Class with driver Davies) was transferred to the north bank. The ferry remained in operation until 16 April 1915, when the temporary bridge came into operation, which allowed the train ferry, the wagon pontoons, motor launches and whaleboats

The normally quiet, isolated town of Upington was a hub of activity and anxiety during the period when the SAR engineers were trying to get improved access over the Orange River. The Rebellion was at its height, with Upington right in the middle of it. Frantic military operations were under way to protect the town from a rebel attack, which came on 24 January 1915.

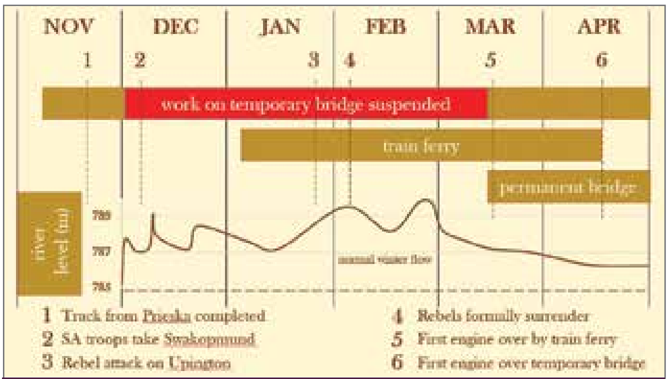

Figure 8: Construction activity at Upington in 1914/15

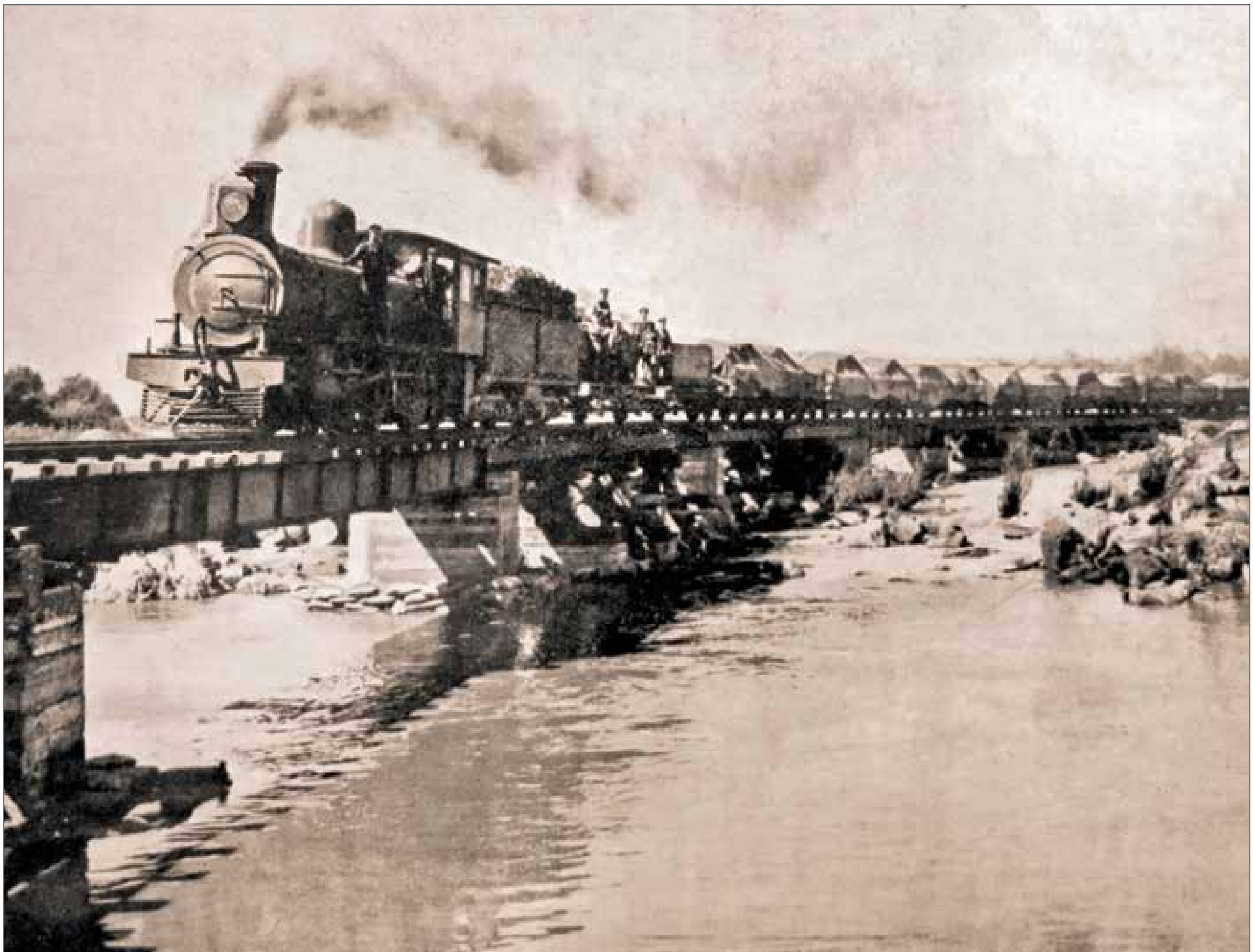
Figure 7: The first test crossing of the temporary low-level bridge (*South African Railways and Harbours Magazine*, June 1915)

to be dispensed with. The Resident Engineer, however, kept the ferry "in readiness to resume work should the low level bridge be in danger from further floods in the late autumn."

The train ferry remained in service for 33 days and was only interrupted for three nights (26 to 29 March, when the southern pier had to be extended, necessitated by a drop in water level). During this time, the ferry transferred 64 km of track material, 56 km of telegraph material, 3 locomotives, 6 travelling tanks, 6 cabooses, and large quantities of supplies and coal.

The train ferry was designed and built by Engineer Greathead under the supervision of Bridge Engineer James Mackenzie, the latter singled out for the "successful ingenuity", "skilful designing of the work, plant and all details" and the "careful personal supervision" brought to his task. Adding to the difficulties to overcome, was the excessive heat in Upington from January to March: "Climatic conditions were unfavourable for rapid work on account of the extreme heat. The thermometer would daily indicate a maximum of from 100 to 120°F [38 to 49°C] in the shade. This could not fail to affect men brought from more temperate parts of the country."

The construction of the train ferry was a rather unusual project for the newly formed SAR, requiring a variety of specialised tools and materials not normally held in stock. The role of the Stores Department, to procure and supply these items at short notice, was recognised: "… the important and very valuable services of the Stores Department of the SAR deserve more than a passing notice. To cross the Orange River at Upington a considerable quantity of material such as wire rope, tackle, launching gear, etc., had to be supplied and also supplies of pitch pine logs and other timber, with bolts, etc., for use in the construction of the temporary bridge. In addition to permanent way material, very large quantities of tools and stores of a general nature were requisitioned, these including water tanks, water carts, pumps, marquees, tents, harnesses, trolleys, wheelbarrows, picks, shovels and hammers, and a host of miscellaneous but equally necessary articles."

Was the great expense and effort invested in the train ferry justified, given its limited time of operation? Engineer Greathead provided his own contemporary perspective: "It may appear that the efforts involved in the provision of the temporary train ferry were hardly called for, seeing that it was in use for only a little more than a month. It is as well therefore to point out that its construction was undertaken as a military measure at a time when it was impossible to determine how long the seasonal floods would last. They have been known to continue to the end of the month of May. That the construction was not completed in less time was due to the unfavourable conditions."

THE TEMPORARY BRIDGE – SECOND ATTEMPT

The work on the temporary bridge was interrupted when the Orange River came down in flood on 1 December 1914. Early in March 1915 the Orange River began to subside and on 15 March, one day after the train ferry came into operation, it was possible to resume work on the temporary bridge.

As pointed out earlier, advantage was taken of the numerous islands which usually divide the river in a number of channels. The crossing consisted of a series of 11 separate bridges totalling 479 m in length. The spans were supported on timber trestles, supported in turn on small concrete foundations. Some remnants of the temporary bridge footings could still be observed in 2014. The bridge was designed and its construction supervised by James Mackenzie, the same engineer in charge of the train ferry. Again, his contribution was singled out – this time for the "speed with which … [it was] constructed".

The first train crossed the bridge a mere 31 days after construction resumed, on 16 April 1915. This time, fortune smiled on the low-level bridge and no more flooding occurred after its completion. It remained in operation until a permanent bridge at higher level came into operation a few months later. Figure 7 shows its first test crossing.

FINALLY – THE PERMANENT BRIDGE

The temporary low-level bridge was not designed to withstand floods like those experienced a few months earlier. A new permanent low-level bridge of concrete and steel was therefore designed "high enough to be clear of such floods as those of the last season and strong enough to withstand even higher floods". As before, advantage was taken of the dyke in the river bed, separating the bridge in two sections of 94 m and 811 m respectively, for a total length of 905 m. In total, there are 101 spans consisting of concrete piers from 2.4 m to 3.0 m high and rolled steel beams from 7.6 m to 12.2 m spans.

The permanent bridge was completed on 30 August 1915. It was the longest railway bridge in South Africa. The bridge was replaced in 1938 with a new bridge of 1 067 m long at a higher level running close to the permanent bridge of 1915. (The bridges at Upington held the record for the longest railway bridges in South Africa from 1915, until overtaken in 1970 by the 1 200 m rail bridge over the Orange River at Bethulie).

The normally quiet, isolated town of Upington was a hub of activity and anxiety during the period when the SAR engineers were trying to get improved access over the Orange River. The Rebellion was at its height, with Upington right in the middle of it. Frantic military operations were under way to protect the town from a rebel attack, which came on 24 January 1915. The attackers were successfully repelled, which effectively brought the Rebellion to an end as the Rebels surrendered early in February. The Rebellion was not the only military threat – a German contingent and Union forces clashed at the same time (4 February) at the nearby town of Kakamas, with the attackers also successfully repelled. Figure 8 provides some context of the military turmoil at the time.

The construction of the railway line from Upington, apart from survey and earthworks, could obviously not proceed without track material and rolling stock. The completion of the train ferry marked the official start of the 277 km dash to Kalkfontein across hostile and enemy territory, which is the theme of the third and final part of this series.

ACKNOWLEDGEMENTS

The three parts of this series relied heavily on material obtained through Yolanda Meyer of the Transnet Heritage Library. Footnotes and referencing were omitted in this version, but a fully referenced copy is deposited with the Transnet Heritage Library and is also available from the author. Further useful material was found in early copies of the SAICE magazine/journal – a valuable resource for all interested in the history of civil engineering in South Africa.

Johan de Koker, Francis Legge, Bill James and Chris James provided pleasant company and stimulating conversation in a sweltering Upington where we hunted for, and found, relics of the earlier attempts to cross the Orange River.

JAMES MACKENZIE (1862–1941)

James Mackenzie was born in Blairgowrie, Scotland, on 1 September 1862. He trained in Scotland and worked on the reconstruction of the Tay River Bridge at Dundee between 1883 and 1887. He came to South Africa in 1889 to join the Cape Government Railways (CGR) and was put in charge of the construction of the Don Pedro Jetty at the harbour in Port Elizabeth. After completing the jetty, he joined the Natal Government Railways (NGR) in 1890 to build the railway line from Ladysmith to Harrismith up Van Reenens Pass, where reversing stations were used in South Africa for the first time. Hereafter he joined a private contractor to build the Pretoria–Pietersburg line. Here he disagreed with the contractor on the method of construction. Rather than allowing his specifications to be altered, he resigned. He soon joined another contractor to build the Dundee–Vryheid line.

This project was interrupted by the hostilities of the Anglo-Boer war and Mackenzie had to get out in such a hurry with his wife and children that he sacrificed most of his furniture. He returned to the employ of the CGR to build the Kalabas Kraal–Hopefield and Amabele–Butterworth lines. His interest in, and early experience in bridge design and construction, was rewarded in 1905 when he was appointed as Engineer-in-Charge (Bridges) of the CGR. After Unification in 1910, he retained his position as bridge expert and became Bridge Engineer of the SAR. At this time, many of the old bridges had to be strengthened due to heavier locomotives and increased axle loads. Mackenzie's experience in this regard led to his paper, *The strengthening of wrought-iron bridges on the Cape Government Railways*, in the January 1913 *Proceedings* of the ICE (Institution of Civil Engineers) in London, and its subsequent award with the coveted Telford Medal. During his time in office, he was responsible for the design and construction of a great many bridges, the most spectacular being the Sauer Bridge over the Gamtoos River. Mackenzie was a keen protagonist of bulk handling of coal and maize, and did much to focus attention on the value and importance of grain elevators for bulk storage.

After his retirement in 1922 at the age of 65, he remained active as engineer. He was consulted to design the bridge across the Limpopo River north of Messina, which he completed. However, a competing design of a rival engineer was selected for construction, and Mackenzie took on the job as Engineer-in-Charge for supervising the construction of his competitor's bridge. He then undertook a trying survey of 300 miles near the present border between Zambia and Malawi along the Luangwe River. He was the only white man, assisted by a single interpreter, in a deadly climate and a country infested with lions and other wild animals, where he often had to sleep without shelter. He pulled off "a first class job" and was handsomely paid.

Mackenzie was a member of the ICE for more than 50 years, and was elected as the President of the Cape Society of Civil Engineers (the forerunner of SAICE) in 1915. He died at Woodleigh Banket near Salisbury on 11 January 1941. At one point in his life, he suffered a personal setback when his wife suddenly died. He suffered from terrible shock, and its complications landed him in hospital for months while he slowly recovered to his full health. At his retirement, one colleague described him as "one of the hardest workers he had ever known, and as one of the most unassuming of men." At his death, he was described as a "man of quiet disposition, kept well ahead of engineering practice elsewhere and was a perfectionist in his work".

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JAMES MERRIMAN GREATHEAD (1884–1965)

James Merriman Greathead was born on 15 July 1884 in Grahamstown, South Africa. He was educated at St Andrews College, Grahamstown, before continuing his schooling in England at Sherbourne School in Dorset and King's College in London. He entered Christ College, Cambridge, in 1904 and qualified as an engineer in 1907, with honours in Mechanical Sciences. He worked in the Airdale Foundry (builders of steam locomotives) and at Leeds Corporation Waterworks for two years before returning permanently to South Africa in 1910.

Greathead started his long career with the SAR on 17 February 1910 as Assistant Engineer on the construction of the railway line between Lady Grey and Barkly East. He was promoted in 1911, and again in 1913. By the end of 1913 he was transferred to Head Office in Johannesburg to work on relaying and main line improvements. At the start of World War One he was Assistant to the Construction Engineer, and was sent to work on the urgent river crossing at Upington. In 1915 he was appointed as District Engineer at Upington, soon married Dorothy Charlotte Greathead (a cousin's daughter), and left for England where he joined the Royal Engineers at Aldershot, building bridges with the 103rd Field Company in France. He took part in seven major actions between 1916 and 1918, earning a Military Cross in 1919, receiving the award personally from King George V. The couple sailed for South Africa in February 1919.

Back in the service of the SAR, numerous deployments followed. In 1920 Greathead served as District Engineer in Bloemfontein, moving to Cape Town in 1921 to work on a grain elevator. From 1922 to 1924 he was back in Head Office, in 1925 the Resident Engineer on the construction of the Addo–Kirkwood line, and in 1927 posted to Durban where he was promoted to System Engineer. In 1934 he was appointed as Inspecting Engineer in Johannesburg, promoted to Assistant Chief Civil Engineer in 1935, and on 1 July 1938 again to Chief Civil Engineer. During World War Two he assisted the Defence Department with the construction of heavy gun positions around Durban and Cape Town. In 1940 he was called up for fulltime service at Defence Headquarters, where he established and organised a number of engineering companies for road, railway, harbour and general construction, all of which saw service in Abyssinia (Ethiopia), North Africa, Palestine (Israel), and Italy. On 5 October 1940 he was recalled to Johannesburg to take up the position of Assistant General Manager (Technical), while continuing his defence work on a part-time basis. He retired from railway service in July 1945 to a farm in White River. He maintained an active interest in the Anglican Church and was engaged as Consulting Engineer to the Nyasaland (Malawi) Railways. He was a Director of Tavistock Colliery Witbank and Dorman Long Africa Limited until two years before his death at White River in June 1965.

James Merriman Greathead, described as a man of good humour and personal charm, was a descendant of a remarkable engineering family who arrived in South Africa as part of the 1820 Settlers. His uncle, James Henry Greathead, was an engineer famous for developing the Greathead Shield, a key component of the construction of the London tube system. Two of his brothers, Harold Merriman Greathead and Arthur Merriman Greathead, were also civil engineers educated in England, as was his son Philip James Greathead. □

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