IPENZ ENGINEERS NEW ZEALAND

ENGINEERING HERITAGE NEW ZEALAND

IPENZ Engineering Heritage Register Report

Kopu Bridge

Written by: Georgina Fell
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Kopu Bridge, June 2010. Photo supplied courtesy of New Zealand Transport Agency

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A. General information

Name: Kopu Bridge

Alternative names: Hauraki Bridge; State Highway 25 Bridge; Waihou River Bridge

Location:

Waihou River

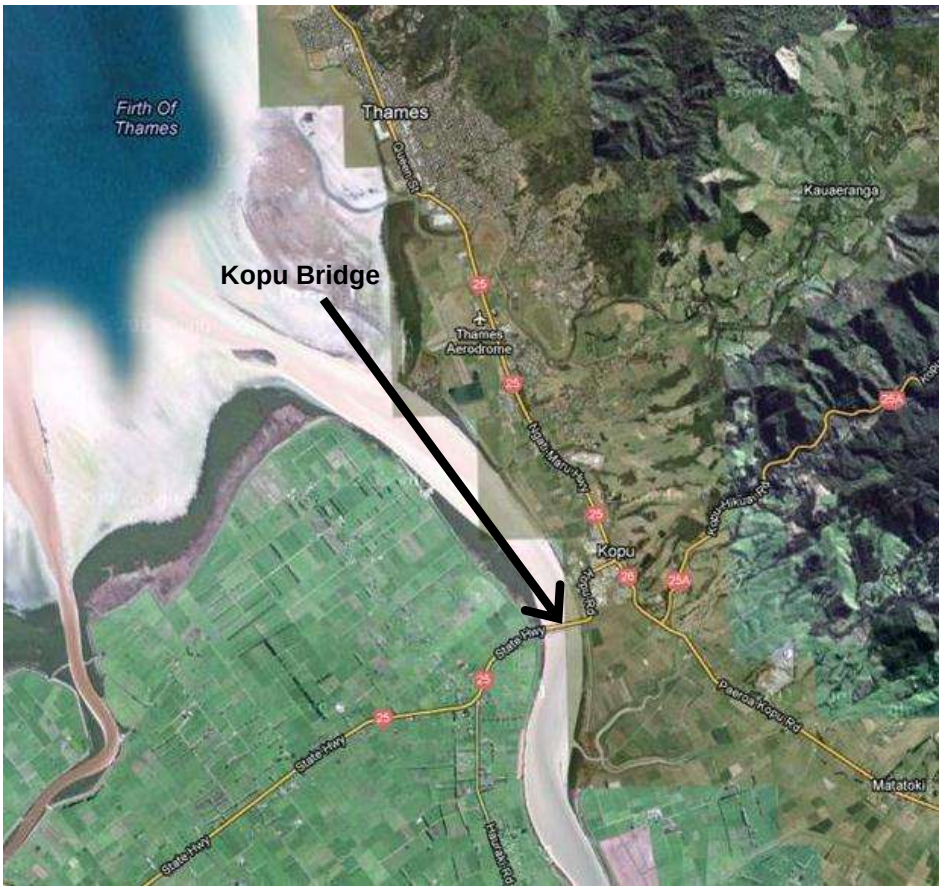
Kopu

Geo-reference: (Centre of structure) Latitude: -37.191. Longitude: 175.563

Legal description: Riverbed: No legal description. Sec 11 Blk I, Sec 1A Blk X, Sec 1-3 Blk Vii, Sec 2 Blk XII, (CT SA179/217), Thames Survey District

Access information: The Kopu Bridge is beside the State Highway 25 road bridge, crossing the Waihou River at Kopu, just south of Thames.

City/District Council: Hauraki District Council (west side of river); Thames-Coromandel District Council (east side of river)



Location map courtesy of GoogleMaps

IPENZ category: Engineering Work

IPENZ subcategory: Infrastructure – Bridge

IPENZ Engineering Heritage number: 151

Date registered: 24 April 2012

Other IPENZ recognition: N/A

Other heritage recognition:

- *New Zealand Historic Places Trust*: Category 1 historic place (Register no.4681)
- *Local Authority District Plan*: N/A
- *Other:* N/A

B. Description

Summary

Until recently the Kopu Bridge was part of State Highway 25, spanning the Waihou River just south of Thames. Completed in 1928, it is significant as the sole remaining example of a swing span bridge in New Zealand. This type of bridge opens to let river traffic through, much like a gate.

While the early prosperity of the Hauraki-Coromandel region was derived from timber, gold, and kauri gum industries, the early 20th century drainage and development of the Hauraki Plains led to a boom in dairy farming. A need for increased access resulted. Discussions about the need for a bridge crossing the Waihou River close to the river mouth had begun as early as 1911. Residents considered the resulting bridge one of the most important public works in the district. The Kopu Bridge provided an important link between Thames and the Hauraki Plains, and considerably shortened the distance between Thames-Coromandel and Auckland. The project was undertaken by the Public Works Department (PWD), with a significant financial contribution from the recently established Main Highways Board.

After World War Two the bridge became increasingly important for providing passage for the growing amount of traffic between Auckland and the Coromandel Peninsula. A decline in river traffic meant that the swing span was retired from regular openings in the late 20th century, but has continued to be opened by arrangement for special occasions until the late 20th century. By the early 1990s the Kopu Bridge had become the most heavily used single-lane road bridge in New Zealand. The Kopu Bridge was no longer able to cope with the peak traffic of the holiday period, therefore in late 2011 a new two-lane bridge was completed immediately upstream of the existing structure. Currently, the future of Kopu Bridge is uncertain.

The Kopu Bridge is a structure of importance to New Zealand's engineering heritage. This is largely because of the provision made in its design to allow the considerable amount of river traffic which once operated on the Waihou River to pass under or through it. It is also indicative of a period when New Zealand transport was changing, and roading began its challenge to rail and shipping as the dominant means of passenger transportation. The Kopu Bridge is also the legacy of the skilled PWD engineers, John Ernest Lelliot Cull (1879-1943) and Onslow Garth Thornton (1890-

1972), who found creative solutions to the unusual set of circumstances particular to the site.

Historical narrative

With its source in the Mamaku Plateau near Putaruru, the Waihou River travels northward along the eastern side of the Hauraki Plains, before flowing out into the Firth of Thames. This river is associated with early European exploration of New Zealand. The first European craft to enter the Waihou River were two manned boats from Captain Cook's ship the *Endeavour*, in November 1769. They spent two days travelling on the river, reaching a point about 20 kilometres (km) from the sea, before returning to the ship.[1] Later, in June 1820 the Church Missionary Society missionary Samuel Marsden (1765-1838) came up the river by ship's boat from H.M.S. *Coromandel*.[2] Marsden was hoping to find a practical overland route to Tauranga and he spent 10 days exploring the Waihou and Ohinemuri Rivers, making it as far as the Karangahake Gorge.[3] In 1842 Joshua Thorp and family moved to the Paeroa area, becoming the first European settlers to take up land on the banks of the Waihou River.[4] At this time there were few roads and the river was the most practical highway.

In the 19th and early 20th centuries there was extensive traffic using the Waihou River for transporting goods and passengers. The first steamer used on the river was the *Gemini* in 1867.[5] The Northern Steam Ship Company of Auckland later maintained a regular service to Puke, near Paeroa, for many years.[6] One of the company's best known vessels on this route was the *Taniwha* which had an unenviable record of eight mishaps.[7] Two involved collisions with the swing spans of the Puke Bridge in 1916, and the Kopu Bridge in 1928, soon after their completion.[8]

Before the Kopu Bridge was built, the Puke Bridge was the nearest bridge to the mouth of the river. However, earnest negotiations between the PWD and local authorities had begun before the Puke Bridge's construction, as early as 1911.[9] A number of sites between Paeroa and the river mouth were proposed, some of which

[1] C. Furniss, *Servants of the North: Adventures on the Coastal Trade with the Northern Steam Ship Company*, Wellington, 1977, p.35

[2] C. Furniss, *Waihou – The River with a Past*, Auckland, 1972, p.3

[3] Furniss 1977, p.36, 39; Furniss 1972, p.3

[4] Furniss 1977, p.39

[5] G. Thornton, 'Heritage Assessment – Kopu Bridge,' IPENZ, 2004

[6] Ibid.

[7] Ibid.

[8] Ibid. The Puke Bridge was completed in 1915 and replaced by the current structure in the 1960s. I. Wallis, 'Memories of the Hauraki Plains Ferries,' *Ohinemuri Regional History Journal*, September 2006, URL: http://www.ohinemuri.org.nz/journal/50/hauraki_plains_ferries.htm (accessed 10 January 2012)

[9] New Zealand Historic Places Trust (NZHPT), 'Building Classification Committee Report,' 25 June 1990, p.3

had been the locations of the various ferries and punts that had serviced the river. After the Hauraki Plains were opened to dairying and greater settlement, the existing services became inadequate and for locals it became imperative that bridges replace them.[10] By the mid 1920s there was a good metalled road between Pokeno and the Hauraki Plains.[11] Kopu was finally decided upon as the best location for the new bridge because it could be connected into this existing network relatively easily, providing the shortest possible route for the greatest amount of traffic.[12]

The bridge's coincided with an increased focus on road transport in the early decades of the 20th century, which culminated in the passing of the Main Highways Act in 1922. This recognised the need for centralising the funding for the country's main highways' and co-ordinating their development and maintenance. The Act created the Main Highways Board to control some 10,000 km of road which had been declared main highway.[13] Initially the Board split construction costs equally with local authorities, and subsidised maintenance and repairs by a third.[14] Later contributions were at the Board's discretion.[15] The Board funded many concrete bridges as road transport accelerated in the interwar years. For example, in 1935 it provided the funds for 250 bridges.[16] Planning for the significant and substantial Kopu Bridge Project was amongst the first undertaken by the Board, being started in 1922.[17] The Board's eventual contribution towards the Kopu Bridge was £22,000, the remainder of the estimated £52,000 being raised by local authorities: the Hauraki Plains County, and Thames County and Borough Councils.[18]

The Kopu Bridge was designed by John Ernest Lelliot Cull (1879-1943), the first design engineer of the PWD, a position he held from 1914 to 1929. Cull was born in Christchurch and educated at Christchurch Boys High School and Canterbury College School of Engineering, taking a Bachelor of Science degree in Engineering.[19] Later Cull joined the staff of Canterbury College and was frequently consulted by

[10] Baker, p.371-372

[11] Ibid., p.371

[12] Ibid., p.372

[13] Carl Walrond. 'Roads - Centralised road funding', Te Ara - the Encyclopedia of New Zealand, URL: http://www.TeAra.govt.nz/en/roads/6 (updated 26 November 2010)

[14] Ibid.

[15] Ibid.

[16] Jock Phillips. 'Bridges and tunnels - Building bridges and tunnels', Te Ara - the Encyclopedia of New Zealand, URL: http://www.TeAra.govt.nz/en/bridges-and-tunnels/2 (updated 26 November 2010)

[17] 'Kopu Bridge,' New Zealand Historic Places Trust Register, URL: http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4681 (accessed 11 August 2011)

[18] 'Bridging the Waihou: Undertaking at Kopu,' *Auckland Weekly News*, 14 October 1926, p.25

[19] 'CULL, John Ernest Lelliot,' IPENZ Engineering Heritage, URL: http://www.ipenz.org.nz/heritage/bio-detail.cfm?id=29 (accessed 16 September 2011)

local bodies on engineering matters.[20] Between 1910 and 1912 he was Assistant Engineer to the Auckland Drainage Board, and Inspecting Engineer to the Auckland Harbour Board in 1913.[21] Later in Cull's career he again returned to Christchurch, taking up the position of chair of Civil Engineering at Canterbury University College. He retained this position until his retirement in 1941.[22] Cull was also Chairman of the Building Regional Committee set up after the 1931 Napier earthquake to draw up standards for earthquake resistant building in the area.[23] He served as president of the New Zealand Institution of Engineers 1936 to 1937.[24]

Supervising construction was engineer Onslow Garth Thornton (1890-1972). Born in Clive, Hawkes Bay, in 1908 Thornton joined the PWD in Wellington as a cadet. From the beginning of his career he was involved in surveys and the construction of roads and railways, coastal protection and river control works. He held the position of Resident Engineer, Paeroa, from 1925-1929. Thornton subsequently became the District Engineer at Gisborne, deputy District Engineer and later District Engineer in Auckland, and shortly before retiring after 42 years of service, District Commissioner of Works at Hamilton. After his retirement he was involved in arbitration and commissions of enquiry on civil engineering matters and later worked for the Auckland Regional Planning Authority. The electric beacon on Kawiti Point, the northern most point of Kawau Island, was renamed Thornton Light in his honour in 1963.[25]

The Kopu Bridge construction began in October 1926. It was designed to the PWD first class standard of loading for traffic bridges. Ship passage on the Waihou River was still a consideration in 1926, so the Kopu Bridge was designed with a swing span, like its earlier partner the Puke Bridge. Other New Zealand swing span bridges were the Kaiapoi Bridge (1863), Heathcote River Bridge, Christchurch (1864), the Tamaki River Bridge, Panmure (1865), the Wanganui River Town Bridge (1869), the Waihou River Rail Bridge at Te Aroha (1885), as well as the Waihou River Bridge at Puke near Paeroa (1912). However, these have now all been demolished, although the swing span of the Tamaki River Bridge remains *in situ* under the Panmure Bridge Marina building, and the Puke Bridge near Paeroa has had its swing span fixed in the

[20] 'Building Classification Committee Report'

[21] 'Obituary: Professor J. E. L. Cull,' *New Zealand Herald*, 24 April 1943, p.9

[22] 'Building Classification Committee Report'

[23] Ibid.

[24] 'CULL, John Ernest Lelliot'

[25] *Who's Who in New Zealand*, Wellington, 1941, p.333; Building Classification Committee Report

closed position.[26] For a country with numerous navigable rivers it is perhaps surprising that more swing, and other moveable, span bridges were not constructed. Navigation requirements for steamers, such as the *Taniwha*, of several hundred tons burden called for a 50 foot wide opening.[27] The Kopu Bridge is the only remaining example of a swing span bridge in New Zealand.[28]

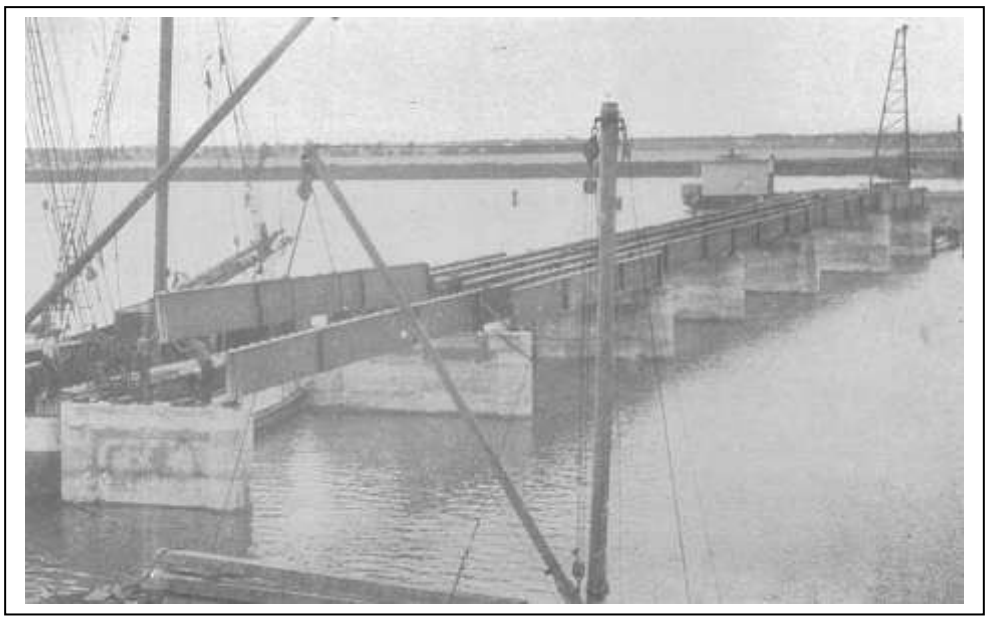


Figure 1: Construction of the Kopu Bridge. *Appendix to the Journals of the House of Representatives*, Wellington, 1927, Vol. II, D-1

The Waihou River's character meant the Kopu Bridge would have to be long. Furthermore, to counteract the soft sand and mud bottom its foundations would have to be deep.[29] In 1924 twelve test piles were driven across the site and at a ceremony two years later the first pile was driven by then Minister of Public Works, the Hon. Kenneth Stuart Williams (1870-1935).[30] The central swing span's construction and the steel girders' fabrication were carried out at the PWD depot in Tauranga.[31] Girders ready for erection were transported by scow around the coast and then lifted straight onto the piers by the scow's winches.[32] The materials used in the **construction of the bridge included nearly 20,000 feet of piles, 400 tons of steel**

[26] 'To the Editor of the Press,' *Press*, 12 September 1863, p. 3; G. Thornton, *Bridging the Gap: Early bridges in New Zealand , 1830-1939*, Auckland, 2001, p.227. Thornton states that the swing span bridge at Kaiapoi was constructed in 1885. However, it seems that this was the replacement structure for the 1863 swing span bridge. This later bridge had a lift span. 'Opening of Kaiapoi Bridge,' *Star*, 31 October 1885, p.3

[27] 'Building Classification Committee Report'

[28] Thornton, (2001) p.14

[29] Baker, p. 372

[30] 'Building Classification Committee Report'

[31] Baker, p.384

[32] Ibid.

girders, 550 tons of cement and 60,000 feet of timber.[33] Over one mile of road approaches were built from dredged river bed material.

The Kopu Bridge was officially opened in May 1928 by Prime Minister Gordon Coates (1878-1943). At the ceremony a ribbon was held across the bridge, and this was cut by the mayoress of Thames.[34] The swing span was then opened and closed for the crowds, after which the Prime Minister and Mrs Coates, together with Messrs Lowe, Walton and Bongard, made the first crossing of the bridge by motor car from the Thames side.[35] The party was followed by over 200 motor cars, containing many old residents of the district.[36] The Ministerial party then took lunch at the Royal Hotel before being motored over to the Hauraki Plains.[37]

Figure 2: Kopu, showing the Kopu Bridge, on the Waihou River, 22 Jan 1968. Alexander Turnbull Library (ATL), Ref: WA-67403-G

Following World War Two the bridge was used by a growing amount of road traffic travelling between Auckland and the Coromandel Peninsula. In 1965 the volume of traffic trying to access the one-way bridge necessitated the installation of traffic lights. By this time a decline in river traffic meant that the swing span's use had lessened

[33] 'Great Day at Thames: Hauraki Bridge Opened, Link with the Plains,' *Auckland Weekly News*, 17 May 1928, p.21

[34] Ibid.

[35] Ibid.

[36] Ibid.

[37] Ibid.

and therefore the bridge keeper was not replaced when he retired in 1964. The swing span remained in fairly regular use until the 1970s, after which it continued to be operated on rare occasions until quite recently.[38] By the early 1990s the Kopu Bridge had become the most heavily used single-lane road bridge in New Zealand. It was around this time that the heritage significance of Kopu Bridge was recognised by the New Zealand Historic Places Trust, with its registration as a Category I historic place in 1990.[39] The structure is said to be "the longest, oldest, and most used single-lane bridge in New Zealand."[40]

[38] 'Building Classification Committee Report'

[39] 'Kopu Bridge' NZHPT

[40] 'Join us for a walk on the new Kopu Bridge,' Thames District Council, URL: http://www.tcdc.govt.nz/PageFiles/6593/Join%20us%20for%20a%20walk%20on%20the%20new%20Kopu%20Bridge.htm (Accessed 24 January 2012)

Social narrative

Bridges were of great importance around New Zealand from the early days of European settlement as they offered a means of crossing potentially dangerous waterways. Due to the high rainfall and steep hill country of New Zealand our rivers can be particularly unpredictable, often changing course and being prone to flooding.[41] The difficulty in crossing these rivers was one factor in drowning being known as the "New Zealand death" in the 19th century.[42] However, there were not always the resources to build bridges when the responsibility for organising and funding them rested with local authorities. Before money could be found for this infrastructure travellers generally had to ford or cross rivers by ferry. This was the case prior to the building of the Kopu Bridge with a ferry punt was used to carry goods and passengers across the river. Compared with a bridge this method was unattractive, being slow, sometimes delayed or unavailable depending on conditions, and there were limitations on how much could be carried across.[43]

The Kopu Bridge's completion was thus greatly anticipated locally and it was described by Prime Minister Coates as "another milestone along the road to progress."[44] The bridge provided an important link between Thames and the fertile Hauraki Plains and was a means of quicker access to Auckland over the Hauraki Plains. The plains had been extensively drained and converted to dairy farming by an Act of Parliament in 1908. In one of the largest and most successful land development schemes in the country, more than 15,000 hectares were distributed to 270 settlers from 1910 to 1914.[45] The bridge's opening was described by one local reporter as "the greatest event in the history of Thames since the days of the gold rush."[46]

The local community and motorists from further afield all rejoiced at the time saved when compared to the inconvenience of the ferry punt.[47] While there were occasional breaks in the flow of traffic when the swing span was in operation, at least this

[41] Thornton (2001), p.15; J. Phillips. 'Bridges and tunnels - The need for bridges and tunnels', Te Ara - the Encyclopedia of New Zealand, URL: http://www.TeAra.govt.nz/en/bridges-and-tunnels/1 (updated 26 November 2010)

[42] 'Bridges and tunnels - The need for bridges and tunnels'

[43] 'Bridging the Waihou: Undertaking at Kopu,'; Thornton (2004)

[44] 'Great Day at Thames: Hauraki Bridge Opened, Link with the Plains'

[45] Paul Monin. 'Hauraki–Coromandel region - Drainage and dairying on the plains', Te Ara - the Encyclopedia of New Zealand, URL: http://www.TeAra.govt.nz/en/hauraki-coromandel-region/9 (updated 13 December 2010)

[46] 'Great Day at Thames: Hauraki Bridge Opened, Link with the Plains'

[47] Thornton (2004)

provided some entertainment for those waiting to cross.[48] Becoming the most heavily used single-lane road bridge in New Zealand in the 1990s, the Kopu Bridge achieved notoriety as the bane of holiday travellers to the Coromandel Peninsula.

Figure 3: "Why are we stopping?" "The Kopu bridge," 30 December, 2008. ATL, Ref: DCDL-0008998

By 2011 the daily number of vehicles using this section of State Highway 25 averaged 9,000, but this number more than doubled during holiday peaks.[49] Therefore, the opening in late 2011 of a two-lane bridge immediately upstream from Kopu Bridge was met with relief. The Kopu Bridge is now redundant but there is strong community interest in retaining the structure because of its heritage value.[50] The NZ Transport Agency, with the Hauraki and Thames-Coromandel District Councils and the New Zealand Historical Places Trust are currently reviewing options for the bridge's future maintenance and use.[51]

[48] Ibid.

[49] 'SH25 Kopu Bridge – Project Overview', New Zealand Transport Agency, URL: http://www.nzta.govt.nz/projects/kopubridge/overview.html (Accessed 17 September 2011)

[50] Thornton (2004)

[51] 'SH25 Kopu Bridge – Project Overview'

Physical narrative

Completed in 1928, the Kopu Bridge represents an engineer's response to a particular set of circumstances: the need to maintain a navigable course for river traffic, the considerable length required to span the river at this point, a soft bottom requiring deep piled foundations, and financial constraints.[52]

Figure 4: The Kopu Bridge, N.Z., June 2010. Photo supplied courtesy of NZ Transport Agency.

The solution to the first of these problems was found in a swing span design, consisting of plate girder spans and reinforced concrete decking with a bituminous concrete top.[53] The total length of the single-lane bridge is 463 metres (m), consisting of 23 18.2 m plate girder spans, with a central swing span of 42.6 m. Eighteen of the bridge spans have a 3.6 m wide roadway, and five spans have a 5.4 m wide roadway. The roadway is flanked by Australian hardwood handrails. The electrically operated swing span formerly opened horizontally on a 90 degree angle, turning on a six m diameter concrete pier, therein providing river vessels with a 15.8 m gap between the fenders. The central operating cabin is a modest corrugated iron shelter with two nine-light windows and a shallow pitched roof.

[52] Baker, pp. 372-73

[53] *Appendix to the Journals of the House of Representatives*, 1928, Vol. II, D-1 p.139

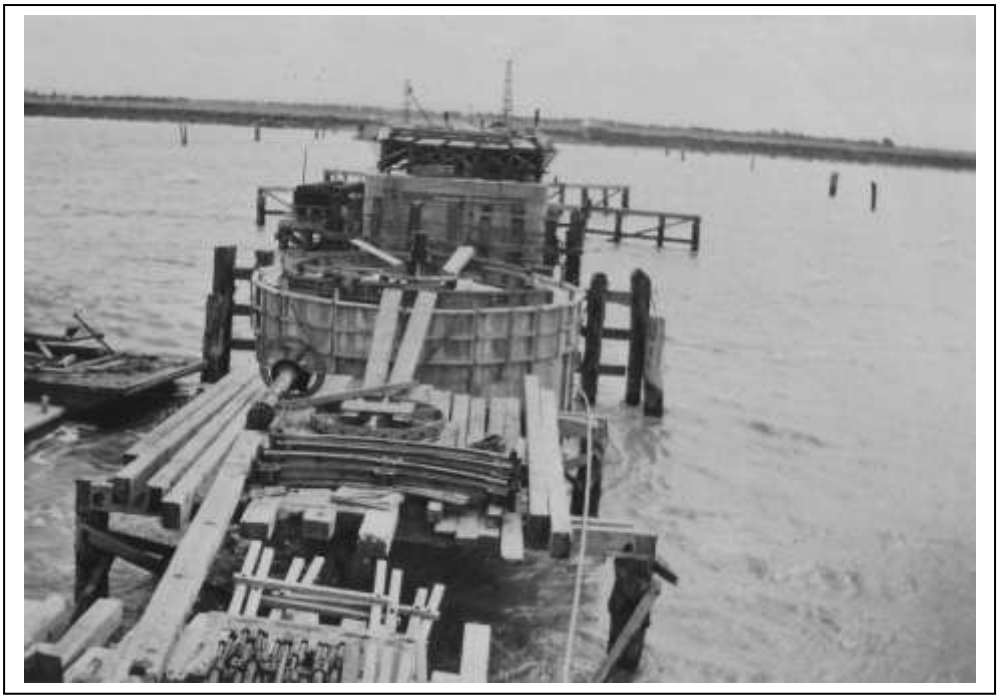


Figure 5: Kopu Bridge under construction, *circa* 1928. Photographer: John Isdale. Image courtesy of Thames School of Mines, Thames. The swing span's concrete pier is at the centre of the image.

The bridge deck is supported on piers, each pier consisting of two groups of composite piles (a timber leader with spliced concrete pile). The heads of each group of piles are enclosed in a cylindrical casting, the whole then surmounted by a dwarf reinforced concrete pier. Piers supporting the 3.6 m wide roadway sections consist of three piles, while those under the 5.4 m wide spans have four piles.

Key physical dates

1926	Construction began
1928	Completed
circa 1960s or 1970s	Addition of weatherboard structure at east end of bridge
circa 1971-1973	Alterations to bridge beside the rotary swing span

C. Assessment of significance

The Kopu Bridge has special heritage significance as the only remaining complete example of a swing span type of bridge in New Zealand. Until recently the structure was the longest remaining single-lane traffic bridge still in use in the country. It is also important because of its association with two significant early 20th century Public Works Department engineers: John Ernest Lelliott Cull and Onslow Garth Thornton.

The Kopu Bridge, with its swing span, reflects the contemporary social and economic importance of river transposition in the area. The bridge was also significant because it catered to the growing local need for road infrastructure as the result of the drainage of the Hauraki Plains and the associated increased settlement of the area.

The Kopu Bridge is of considerable importance in the transport history of New Zealand as one of the first substantial projects planned by the newly formed, and influential, Main Highways Board. Once lauded because it shortened the travelling distance between Auckland and the Coromandel, this landmark structure later became notorious as a cause of delay. This in itself is significant as demonstrative of the vast differences in traffic density from the early decades of the 20th century to the present.

Therefore, the Kopu Bridge is of sufficient engineering heritage significance to merit inclusion on the IPENZ Engineering Heritage Register.

D. Supporting information

List of supporting information

Attach: Baker, A. J., 'Waihou River Bridge, Kopu, and Piled Foundations,' in *Proceedings of the New Zealand Society of Civil Engineers, 1930-31*, Vol. 17 (1931), Wellington, pp.371-397

Link to: Kopu Bridge, New Zealand Historic Places Trust Register, http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4681

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