

IPENZ Engineering Heritage Record Report

Springvale Suspension Bridge

Written by: Simon Daisley and Karen Astwood
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Springvale Suspension Bridge, July 2013. K. Astwood, IPENZ

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A. General information

Name: Springvale Suspension Bridge

Alternative names: Rangitikei River Bridge Number 75, Erewhon Bridge, Rangitikei Bridge

Location:

Rangitikei River

Taihape-Napier Road

Rangitikei

Geo-reference: Latitude -39.488, longitude 176.033

Legal description: Pt Mangaohane 1A (CT 548196); Pt Legal Road (Taihape-Napier Road), Wellington Land District.

Access information: The bridge spans the Rangitikei River and although it is no longer accessible to vehicle traffic it can be accessed by pedestrians from a Taihape-Napier Road rest area on the eastern banks of the river.



Image courtesy of GoogleMaps

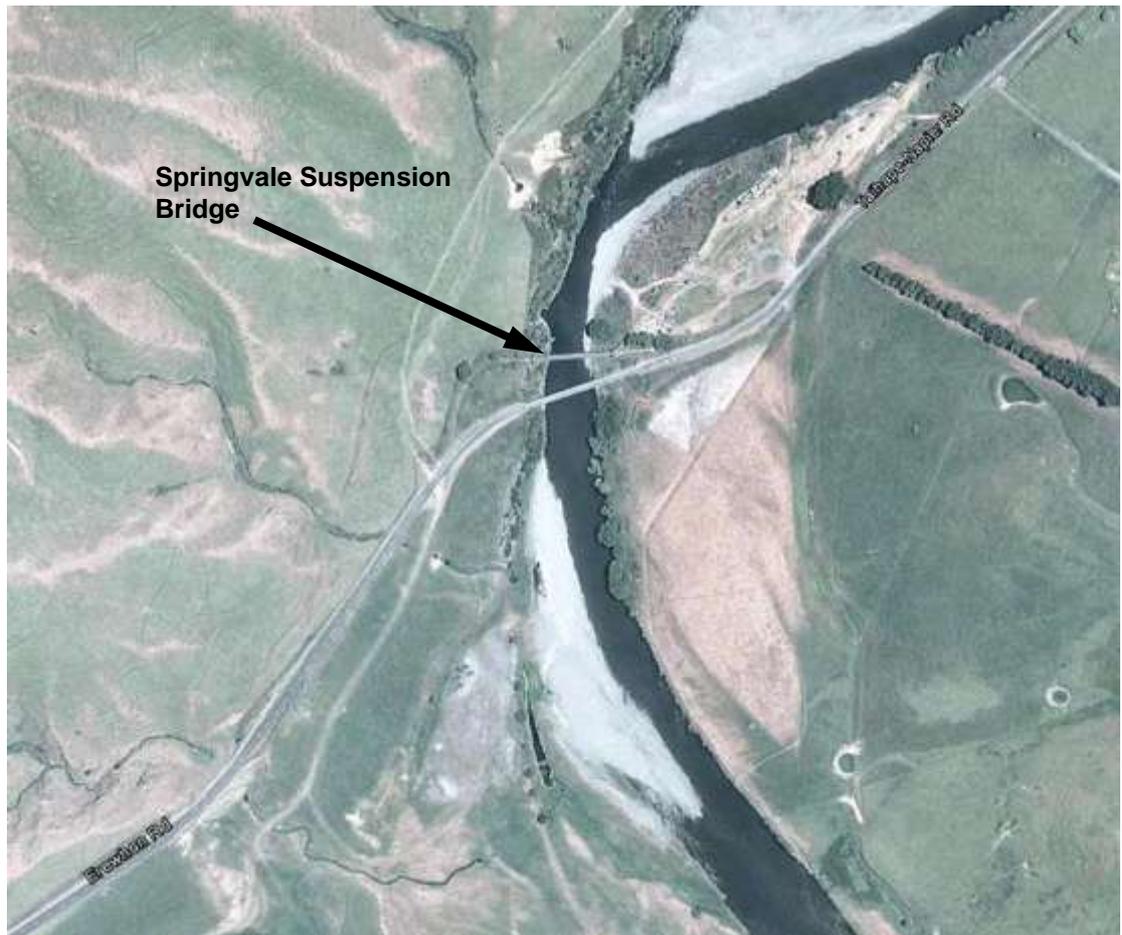


Image courtesy of GoogleMaps

City/District Council: Rangitikei District Council

IPENZ category: Engineering work

IPENZ subcategory: Infrastructure

IPENZ Engineering Heritage number: 164

Date registered: N/A

Other IPENZ recognition: N/A

Other heritage recognition:

- *New Zealand Historic Places Trust: Category 2 historic place (Register No.7535)*

B. Description

Summary

Built between 1923 and 1925, the Springvale Suspension Bridge spans the Rangitikei River, near Inland Pātea's Springvale Station.

European farmers settled this remote area of Rangitikei from the late 1860s, but in the early 20th century it was still relatively isolated, only being accessible using a crude road between Taihape and the port town of Napier. After World War One the Government initiated a scheme to open up and develop areas like Inland Pātea. The resulting Taihape-Napier Road enabled increased transport efficiency for farm produce and Hawke's Bay travellers connecting with the Auckland-bound trains. Motorised transport was becoming increasingly popular at the time and this was factored into the Springvale Suspension Bridge's design. Initially referred to as the Erewhon Bridge, the single lane structure was replaced in the road network in 1970 by a nearby, modern, Callender-Hamilton Bridge.

The Springvale Suspension Bridge was designed by Sydney Arthur Robert Mair (1872-1961), who spent 46 years as the Rangitikei County engineer. Mair was also a founder of the Institute of Local Government Engineers of New Zealand (1912) and the New Zealand Society of Civil Engineers in 1914 (now known as IPENZ). Built by William Salt (1887-1929), the bridge's span is 61 metres (m) and its reinforced concrete towers are 7 m tall. While a number of similar bridges were constructed in the North Island during the period, replacement programmes, like the comprehensive one carried out by the Rangitikei County Council in the 1960s and 1970s, means the Springvale Suspension Bridge is a rare example of a local early 20th century suspension bridge.

The Springvale Suspension Bridge was the first engineering heritage structure to become a New Zealand Historic Places Trust (NZHPT) property in the late 1970s. This is evidence of a broadening of what New Zealanders consider to be heritage. The Springvale Suspension Bridge, now (2013) used as pedestrian bridge, remains a notable local feature.

Historical narrative

Stretching from headwaters in the Kaimanawa Ranges to its final destination in the South Taranaki Bight, the Rangitikei River travels a length of 241 kilometres (km), making it one of the longest rivers in New Zealand. A Māori warrior, Hau, rested on the banks of the river and is said to have named it “the day of striding out” because he had been pursuing his wife and her lover for the length of a day.¹ The river’s eroding effect on the surrounding soft marine sedimentary layering has created steep and wide gorges.²

Although the Ngamatea Plateau, where the Springvale Suspension Bridge was later constructed, was visited by Māori hunting and fishing parties the climate made it unsuitable for permanent settlement.³ Evidence of this usage was found in 1960 near the suspension bridge, including fragments of moa bones, obsidian tools and burnt stone.⁴

One of the first Europeans to venture into the remote interior was the Anglican missionary, Richard Taylor (1805-1873). Based at Putiki near Whanganui, Taylor’s sphere of influence reached the borders of the Inland Pātea and he visited in 1845. In 1847 missionary William Colenso (1811-1899) made an overland journey from Hawke’s Bay. The creation of a route through Kuripapango meant that Inland Pātea was eventually accessible to, and settled by, European Hawke’s Bay farmers. The first were the Birch brothers, Azim (1837-1923) and William (1842-1920), who leased the Kaimanawa-Oruamatua block from local Māori in 1868. Originally consisting of 115,000 acres between the Rangitikei and Moawhango Rivers, they divided the station in two in the 1890s, and William named his portion “Erehwon”, which is “nowhere” spelt backwards.⁵

In the late 19th century the only means for locals and travellers to cross the Rangitikei River in this region was a ford. The construction of the North Island Main Trunk railway in the late 19th and early 20th centuries gave local farmers the option of transporting stock through Taihape instead of Hawke’s Bay. This was particularly

¹ ‘History,’ Rangitikei, <http://www.rangitikei.com/history>, (accessed 18 June 2013)

² Hudson Associates Landscape Architects, ‘Rangitikei District Landscape Assessment,’ Area 5 Rangitikei River Open Valleys (2010), www.rangitikei.govt.nz (accessed 21 June 2013)

³ Hazel Riseborough, *Ngamatea: the land and the people* (Auckland: Auckland University Press, 2006), p.7

⁴ Land Acquisition Fund Committee Head Office, ‘Completion of gifting – Springvale Bridge,’ 21 June 1993, p.3, New Zealand Historic Places Trust 12014-002 Volume 2.

⁵ Riseborough, *Ngamatea*, p.8.

welcome since the condition of the old wagon and stock route down to Napier's port had deteriorated by this time.⁶ Prior to World War One, the Rangitikei County Council and Chamber of Commerce, as well as the Hastings Chamber of Commerce, lobbied the Government for a better road. The need was recognised but the war meant plans were postponed until the early 1920s. Another incentive for developing the road was shortening the travel time from Hawke's Bay to Auckland. Driving five hours from Napier and then taking the train from Taihape to Auckland was much quicker than taking trains the entire way.⁷

A key feature of the road was replacing the existing Rangitikei River ford with a bridge. The Springvale Suspension Bridge was designed by Sydney Arthur Robert Mair (1872-1961), the Rangitikei County's engineer, who is said to have been responsible for some of the earliest reinforced concrete bridges in New Zealand.⁸ Mair had an astonishingly long career for the county in an engineering capacity, beginning as the Inspector of Roads in 1899, then taking over from AR MacKay as County Engineer in 1901 and continuing in the role until 1947.⁹ Mair was one of the longest serving of any of New Zealand's county engineers.¹⁰ The beginning of Mair's county career was contemporaneous with the construction of the North Island Main Trunk railway through the region, and coincided with significant growth in farming and the settlement of towns such as Taihape. As the County Engineer, he had a direct impact on the development of the region from its infancy until the mid twentieth century. Mair was also nationally influential within the engineering profession: in 1912 he was instrumental in establishing New Zealand's first professional body for engineers, the Institute of Local Government Engineers of New Zealand. A few years later, Mair was a founding member of its successor, the New Zealand Society of Civil

⁶ Jocelyn Fannin, 'Landmark's story displayed,' *Central District Times*, 3 February 2009, p.3, New Zealand Historic Places Trust 12014-002 Volume 4.

⁷ 'Napier and Taihape,' *Hawera & Normanby Star*, 7 March 1922, p.3.

⁸ Institution of Professional Engineers New Zealand, 'Sydney Arthur Robert Mair,' <http://www.ipenz.org.nz/heritage/bio-detail.cfm?id=34> (accessed 21 June 2013,). No specific examples of these early concrete bridges are provided in this biography.

⁹ Neil G Hansen and J Noel Hall, *The County Engineers of New Zealand, 1876-1989* (Tauranga, Association of Local Government Engineers of New Zealand, 1993), pp. 44, 45 states that Mair succeeded MacKay in 1899. However, newspaper reports show that this did not occur until 1901 when MacKay became the Wairoa County Engineer. The date for MacKay's move to Wairoa is also inaccurately noted in Hansen as 1902. See 'Rangitikei Notes,' *Wanganui Chronicle*, 11 February 1901, p.2.

¹⁰ Hansen, *The County Engineers of New Zealand*, pp.15-60. Mair's resignation from the position is mentioned briefly in *New Zealand Engineering*, Vol.2:1 (January 1947), p.48. This article says he worked for the County for 50 years. However, a newspaper report confirms that prior to 1899 Mair worked for the Moa Road Board in Taranaki. 'Rangitikei Notes,' *Wanganui Chronicle*, 9 June 1899, p.3. The two county engineers who served longer than Mair were: Campbell Frederick Schadick (1898-1977) who was the Buller engineer for 56 years, and Roy Lindsay Harding (1885-1973) who worked for the Oroua County Council for 48 years.

Engineers and was the Society's President in 1918-1919.¹¹ Mair also served on the Engineers Registration Board around the time when the Springvale Suspension Bridge was constructed.¹²

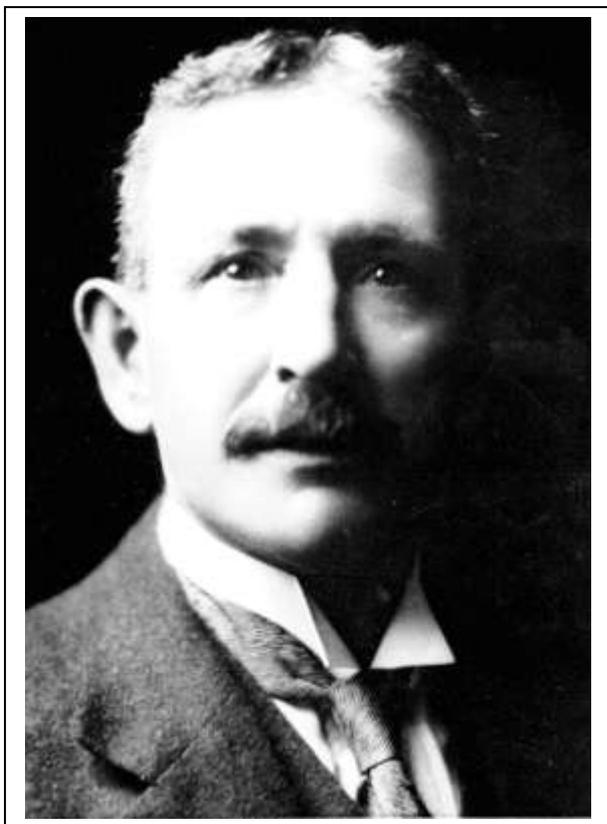


Figure 1: Sydney Arthur Robert Mair (1872-1961). Past Presidents' Album, 1914-1966, IPENZ

Construction on the Springvale Suspension Bridge began in 1923 and was completed in 1925. William Salt, from the Whanganui region, was the contractor. Salt was also known for his efforts in assisting to develop Ruapehu as a resort and promoting mountaineering in the area.¹³ The first vehicle to cross the bridge was a lorry belonging to Mr J. Kilcolly, but it was officially opened in April 1925.¹⁴ The road was eventually completed in 1927 and lauded in the newspapers as a scenic route which offered splendid views of the Central Plateau.¹⁵

¹¹ Hansen, *The County Engineers of New Zealand*, p.45

¹² 'Engineers Board,' *Auckland Star*, 4 April 1925, p.16. He also served for at least two further terms, beginning in 1928 and 1937. 'Personal Matters,' *Evening Post*, 30 March 1928, p.11; 'Personal Items,' *Evening Post* 11 June 1937, p.11

¹³ 'Mr William Salt,' *Auckland Star*, 13 July 1929, p.10.

¹⁴ 'Untitled,' *Auckland Star*, 7 April 1925, p.4; 'Napier-Taihape Road,' *Evening Post*, 2 May 1925, p.23.

¹⁵ 'New Service Route,' *Evening Post*.

Early in its history the Springvale Suspension Bridge was commonly known as the Erewhon Bridge or the Rangitikei Bridge. Springvale is the name of the nearby station on the western side of the river which was originally part of the Kaimanawa-Oruamatua block leased by the Birch brothers.¹⁶ In 2009 Lou Campbell, a former worker at Springvale and Erewhon stations, recounted his experiences in using the bridge during the 1930s. Its narrow width meant the bridge's side bolts would often tear at the bales of wool on trucks and tufts would get stuck in the bridge. Stock were anxious about the bridge and when being moved in *en masse* their urgency to get across typically caused the bridge to sway a lot, often panicking the animals into a stampede.¹⁷

By the late 1960s the bridge no longer met modern traffic requirements and usage was restricted to vehicles with a maximum weight of 12 tons.¹⁸ Indeed, in 1943, late in his county career Mair noted that "[t]he evolution of transport is now such that heavy six-wheeled lorries are...placing a greater strain on lightly metalled roads and light traffic bridges than was expected [when constructed]."¹⁹ The Springvale Suspension Bridge's use as a vehicle bridge came to an end several decades later when the nearby Callender-Hamilton Bridge was completed in 1970. With the bridge facing the threat of demolition, local farmers including Tony Batley, a local New Zealand Historic Places Trust (NZHPT) member, proposed the bridge and close by archaeological site, be protected in some way.²⁰

In 1974 the County Council offered NZHPT the management of the bridge. Although vehicular suspension bridges had been reasonably common in New Zealand during the first half of the 20th century, by the 1970s many of them had either been replaced by modern bridges. The NZHPT accepted the Council's offer on the basis that the Springvale Suspension Bridge was a rare North Island example of this type of bridge in its original condition.²¹

In 1979 a Deed of Gifts was signed between the Department of Lands and Survey and the owners of the Springvale and Otupae Stations, which gifted the bridge abutments land to the Crown. The idea was to establish a historic reserve, but this also required land adjoining the road, which for various reasons was not officially

¹⁶ Diana Beaglehole, 'Whanganui places - Inland Pātea,' Te Ara - the Encyclopedia of New Zealand, updated 13-Jul-12, accessed July 16 2013, <http://www.TeAra.govt.nz/en/whanganui-places/page-8>.

¹⁷ Fannin, 'Landmark's story displayed,' p.3.

¹⁸ 'Research report,' New Zealand Historic Places Trust 12014-002 Volume 3.

¹⁹ 'Roads and Bridges Loads to be Restricted,' *Auckland Star*, 3 December 1943, p.6

²⁰ Ibid.

²¹ Geoffrey Thornton, *Bridging the gap: early bridges in New Zealand 1830-1939* (Auckland: Reed, 2001), p.208.

signed off. This was realised in 1993 and it was decided to make use of an amendment made to the Public Works Act 1981, allowing for land to be taken to establish a historic reserve.²² Further investigations made in 2003 showed that the land transfers had still not taken place.²³

In the meantime, the NZHPT were maintaining the structure. In 1990 a structural survey was completed which recommended the cable anchorages be checked, the drainage channels cleared and the willows that had grown up through the cables removed.²⁴ The bridge was officially closed to foot traffic in 2001 and in 2003 a Bycroft Petherick report advocated for further repairs.²⁵ In 2004 the heritage values of the bridge were officially recognised when it was entered into the NZHPT Register as a Category 2 historic place. Further routine remedial work at Springvale Suspension Bridge will be completed in 2013.

²² Land Acquisition Fund Committee, 'Completion of gifting – Springvale Bridge,' June 21 1993, in New Zealand New Zealand Historic Places Trust 12014-002 Volume 2.

²³ 'Research report,' New Zealand Historic Places Trust 12014-002 Volume 3.

²⁴ 'Specification for Springvale Bridge remedial work,' report prepared for the New Zealand Historic Places Trust by Morrison Cooper Ltd November 1990, in: New Zealand Historic Places Trust 12014-002 Volume 2.

²⁵ 'Research report,' New Zealand Historic Places Trust 12014-002 Volume 3.

Social narrative

Following the arrival of European settlers, the Ngamatea Plateau and the land surrounding the banks of the Rangitikei was turned into farmland. Since it was difficult to access larger settlements and export opportunities, the Springvale Suspension Bridge's completion in 1925 was a great boon to local farmers, who could now choose to transport their livestock through Taihape rather than travel to Napier.

The Springvale Suspension Bridge was built at a time when motorised transport was becoming more accessible to New Zealanders.²⁶ The bridge allowed motorists to complete a scenic route from Napier to Taihape. Although the bridge is no longer used for road traffic, it is in close proximity to the Taihape-Napier Road and is still a point of interest for travellers. A rest stop on the eastern bank of the river, connecting to the bridge, provides a chance for travellers to admire the structure and the surrounding landscape. The bridge is also noted as a landmark in the Gentle Annie cycle route, one of the many cycle routes which make up the New Zealand Cycle Trail.²⁷

The important role the bridge played in the region's social history was recognised in the 1970s when, faced with demolition, it was retained due to the local community's advocacy and ownership vested with the NZHPT. This early 1970s decision by the NZHPT was the first overt instance of an official broadening of the term heritage to include industrial and engineering structures. As such, the proposal for the NZHPT to take over ownership was initially met with scepticism by some Board members. However, discussion led by new Ministry of Works representative, Geoffrey Thornton (b.1922), convinced the Board on the basis that engineering structures, particularly bridges, were essential to New Zealand's development and therefore have historical and social importance.²⁸ Subsequently the Clifden Suspension Bridge was also transferred to NZHPT ownership, and the NZHPT Register now features many bridges and other engineering heritage structures.²⁹

²⁶ Eric Pawson. 'Cars and the motor industry - A motorised society,' Te Ara - the Encyclopedia of New Zealand, <http://www.TeAra.govt.nz/en/cars-and-the-motor-industry/page-1> (updated 13 July 2012).

²⁷ 'Gentle Annie route,' The New Zealand Cycle Trail, <http://www.nzcycletrail.com/gentle-annie> (accessed 27 June 2013)

²⁸ Geoffrey Thornton interview with Shona McCahon, IPENZ Oral History Project, 22 June 2010, audio file 7. IPENZ

²⁹ Clifden Suspension Bridge, Category 1 historic place (NZHPT Register No.4921). The bridge became an NZHPT property in 1984. See Karen Astwood, 'Clifden Suspension Bridge, Waiiau River,' IPENZ Engineering Heritage Register Report, 3 September 2012, pp.9-10. URL:

[http://www.ipenz.org.nz/heritage/documents/Clifden%20Suspension%20Bridge%20report%20\(560%20KB\).pdf](http://www.ipenz.org.nz/heritage/documents/Clifden%20Suspension%20Bridge%20report%20(560%20KB).pdf) (accessed 31 July 2013)

Physical narrative

The Springvale Suspension Bridge has a single 61 metre (m) span, with a timber deck and concrete towers and abutments. The towers stand at a height of 7 m above the level of the decking. Each pair of towers posts is connected with a concrete tie beam. This beam has a shallow arch shape and the triangular indents in the concrete are subtly ornamental. Each of the post's capitals supports a saddle carrying the suspension cables.

On each side, the deck is suspended from four 140 millimetre (mm) wide cables, wrought from galvanised plough steel. Suspended from tower saddles, the cables pass through ground level timber cable boxes before connecting to a 64 mm diameter rod which is set within a buried concrete anchorage. The decking of the bridge is 2.4 m wide and therefore was only capable of supporting a single lane of vehicle traffic. Every fourth deck joist extends beyond the width of the regular joists. Attached to each protrusion is a brace from the bridge's balustrade/stiffening truss.

Since its closure to road traffic, the bridge has undergone maintenance to replace elements that had deteriorated and to prevent further damage. In 1991 the willows growing up around the cables were removed and drainage channels were cleared. Wire mesh netting was also placed along the length of the posts supporting the upper chords to prevent children from falling between the diagonal braces.³⁰ In 2001 another condition report revealed parts of the timber had started to deteriorate.³¹

Comparisons

In New Zealand, Central Otago is particularly known for its suspension bridges, crossing turbulent rivers such as the Clutha and Kawarau. A feature of Central Otago examples, like the Kawarau Gorge Suspension Bridge (1880), is the use of local stone in the towers. However, other bridges which were built on a more limited budget and designed for pedestrian traffic, such as Horseshoe Bend (1913) which has timber A-frame towers.

In the late 19th and early 20th centuries, reinforced concrete was being developed and by the 1930s had become the predominant material for bridge construction.³² The Clifden Suspension Bridge (1899), Southland, and the Skippers Canyon Suspension Bridge (1901), Central Otago, are early examples of New Zealand

³⁰ Institution of Professional Engineers New Zealand, 'Springvale Suspension Bridge report.'

³¹ Salmond Architects, 'Springvale Bridge Taihape-Napier Road Rangitikei District,' condition report prepared for the New Zealand Historic Places Trust (2001), p.3. New Zealand Historic Places Trust 12014-002 Volume 3.

³² Geoffrey Thornton, *Cast in concrete: concrete construction in New Zealand* (Auckland: Reed, 1996), p.98.

suspension bridges with reinforced concrete towers. A comparable example in the North Island was the Rangitikei River Bridge (1914) between Mangaweka and Utiku on Toetoe Road, designed by Mair. Only the north tower survived after the bridge was replaced in the road network by a modern bridge in 1961.³³

North Island concrete tower suspension bridges seem to have become reasonably popular during, and in the decades after, World War One. Many were designed by Joseph Dawson (1843-1923), including: the Mokai Suspension Bridge (1914) over the Rangitikei River, a private bridge at Maoribank (1917) and two bridges at Upton Brook in Marlborough (*circa* 1920s).³⁴ By the 1970s these bridges had either been demolished or had their decking removed, leaving only the reinforced concrete towers.³⁵ Perhaps the most prominent example of one of a Dawson bridges is the Tane Hemp Company Limited's former structure at Opiki (1918). Its 145.4 m span was the second longest of any pre-1940 New Zealand road bridge; only the towers and cables remain.³⁶ Further examples include a 1924 series of five road bridges cross the Mangaheia River on Tauwhareparae Road north of Tologa.³⁷ They were eventually partially or completely demolished too.³⁸

Therefore, the Springvale Suspension Bridge seems to be a rare North Island example of a typical, early 20th century concrete tower suspension bridge. Also, given the seemingly comprehensive nature of the Rangitikei County Council's 1960 and 1970s bridge replacement programme, it is likely that the Springvale Suspension Bridge is Mair's only remaining extant bridge.

Key physical dates

1923	Construction on the bridge begins
1925	Construction is completed
1970	Closed to motor traffic
1990	Structural survey and maintenance
2013	Repair and maintenance work.

³³ Thornton, *Bridging the gap*, p.203.

³⁴ *Ibid.*, pp.203 -205.

³⁵ *Ibid.*

³⁶ Karen Astwood, 'Tane Hemp Company Limited Suspension Bridge and Flaxmill remains, Opiki (Register No.9619),' registration report prepared for New Zealand Historic Places Trust (6 June 2013), pp.12, 15.

³⁷ Thornton, *Bridging the gap*, p.204.

³⁸ *Ibid.* Two of suspension bridges appear to have been partially retained (the decks have been removed) and have been identified using GoogleEarth. They are visible from the current bridges (2013): Mangaheia Bridge No.1 (latitude -38.325, longitude 178.180), and Mangaheia Bridge No.3 (latitude -38.327, longitude 178.170)

C. Assessment of significance

Built between 1923 and 1925, the Springvale Suspension Bridge has local social and economic significance as an example of the efforts made by both local and central government to open up the Inland Pātea region for settlement and travellers. The widening of New Zealander's definition of heritage in the 1970s and 1980s to include engineering and industrial structures is also connected to the Springvale Suspension Bridge which became the NZHPT's first such property. Designed by Sydney Arthur Mair, an important New Zealand and longstanding Rangitikei County engineer, the Springvale Suspension Bridge is a rare extant example of one of his bridges. Indeed, this structure is one of the earliest remaining suspension bridges in the North Island.

Therefore, Springvale Suspension Bridge is of sufficient engineering heritage significance to merit inclusion on the IPENZ Engineering Heritage Record.

D. Supporting information

List of supporting information

'Springvale Suspension Bridge,' New Zealand Historic Places Trust (NZHPT)

Register information, URL:

[http://www.ipenz.org.nz/heritage/documents/Clifden%20Suspension%20Bridge%20report%20\(560%20KB\).pdf](http://www.ipenz.org.nz/heritage/documents/Clifden%20Suspension%20Bridge%20report%20(560%20KB).pdf) (accessed 27 June 2013)

Institution of Professional Engineers New Zealand, 'Sydney Arthur Robert Mair,'

accessed June 21 2013, <http://www.ipenz.org.nz/heritage/bio-detail.cfm?id=34>.

Bibliography

Archival/Primary sources

Available from Institution of Professional Engineers New Zealand National Office, Wellington:

Thornton, Geoffrey. 'Horseshoe Bend Bridge Clutha River.' IPENZ Heritage Assessment, 2007.

Thornton, Geoffrey, interview with Shona McCahon, IPENZ Oral History Project, 22 June 2010.

Available from New Zealand Historic Places Trust (NZHPT) Central Region Office, Wellington:

Springvale Suspension Bridge. NZHPT 12014-002 Vols. 1-4.

Electronic sources

'Gentle Annie route,' The New Zealand Cycle Trail,

<http://www.nzcycletrail.com/gentle-annie> (accessed 27 June 2013).

'History,' Rangitikei, <http://www.rangitikei.com/history> (accessed 18 June 2013).

Beaglehole, Diana. 'Whanganui places - Inland Pātea.' Te Ara - the Encyclopedia of New Zealand, <http://www.TeAra.govt.nz/en/whanganui-places/page-8> (updated 13 July 2012)

Hudson Associates Landscape Architects, 'Rangitikei District Landscape Assessment,' Area 5 Rangitikei River Open Valleys (2010), www.rangitikei.govt.nz (accessed 21 June 2013).

Hudson Associates Landscape Architects, 'Rangitikei District Landscape Assessment,' Area 3 Ngamatea Plateau (2010), www.rangitikei.govt.nz (accessed 21 June 2013).

Pawson, Eric. 'Cars and the motor industry - A motorised society.' Te Ara - the Encyclopedia of New Zealand. <http://www.TeAra.govt.nz/en/cars-and-the-motor-industry/page-1> (updated 13 July 2012).

Available from PapersPast, www.natlib.govt.nz

Auckland Star, 4 April 1925, 7 April 1925, 13 July 1929, 3 December 1943.

Dominion, 20 March 1920.

Evening Post, 25 July 1919, 2 May 1925, 26 November 1927, 30 March 1937, 11 June 1937.

Hawera & Normanby Star, 7 March 1922.

New Zealand Herald, 7 March 1923.

Wanganui Chronicle, 9 June 1899, 11 February 1901.

Published/secondary sources

New Zealand Engineering, 2:1 (January 1947)

Hansen, Neil G and J Noel Hall. *The County Engineers of New Zealand, 1876-1989*. Tauranga: Association of Local Government Engineers of New Zealand, 1993.

Riseborough, Hazel. *Ngamatea: the land and the people*. Auckland: Auckland University Press, 2006.

Thornton, Geoffrey. *Bridging the Gap: Early bridges in New Zealand 1830-1939*. Auckland: Reed, 2001.

Thornton, Geoffrey. *Cast in concrete: concrete construction in New Zealand*. Auckland: Reed, 1996.