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Cover Images:

Front: Steam Roller Salisbury, celebrating 150 years of mechanised transport in Tasmania, drives under the Tasman Bridge in Hobart and is about to pass the east shore abutment of the former Floating Bridge. (see pages 12 and 6)
Photo: The Martin family.

Back: Making Glass to Music – musicians playing a glass violin & glass 'cello entertain workers in the glass furnace hot shop in the former Boilerhouse of the former Kingston Powerhouse in Canberra on the 8th birthday of the Glassworks and the 100th year of the Powerhouse (see pages 3 to 5).
Photo: Judy Baker.

This is a quarterly magazine covering stories and news items about engineering and industrial heritage in Australia and elsewhere. It is published online as a downloadable PDF document for readers to view on screen or print their own copies. EA members and non-members on the EHA mailing lists will receive emails notifying them of new issues with a link to the relevant Engineers Australia website page.

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EDITORIAL

There was so much information packed into this issue that there was no space left to fit in an editorial page. A pity, because I thought I had much to say – and even a few more pictures!

However, I don't want to miss out thanking the 150+ readers who emailed YES, they had opened the June 2015 Magazine. I am told that only 328 people in all downloaded the magazine from the website (i.e. read it or part of it). I find this puzzling, because if nearly 50% of people who opened the magazine emailed that they had done so, my (admittedly ancient) knowledge of survey statistics tells me that this was a complete aberration. I will investigate!

In case you are wondering why October, and not September this time, the magazine remains a quarterly, but will be issued in January, April, July and October in future – for various reasons, but particularly including the previous coincidence of the December magazine with the Christmas season and other holidays and an ever more extreme bush fire season, and risk, where we live.

I hope you don't mind the wait for this issue. We have found some great stories – including a 1910 steam roller on a jaunt from Glenorchy to Bellerive and back again in Hobart, a goldmine in WA developed by a young man who became President of the United States, a bridge which floated on its side and another which drowned, trams in Hong Kong, a swimming pool in Canberra, a famous physicist, and a book which will have 100 stories of Australian engineering achievements. Enjoy!

The Editor

From the Chair – the Kingston Power Station, Canberra.

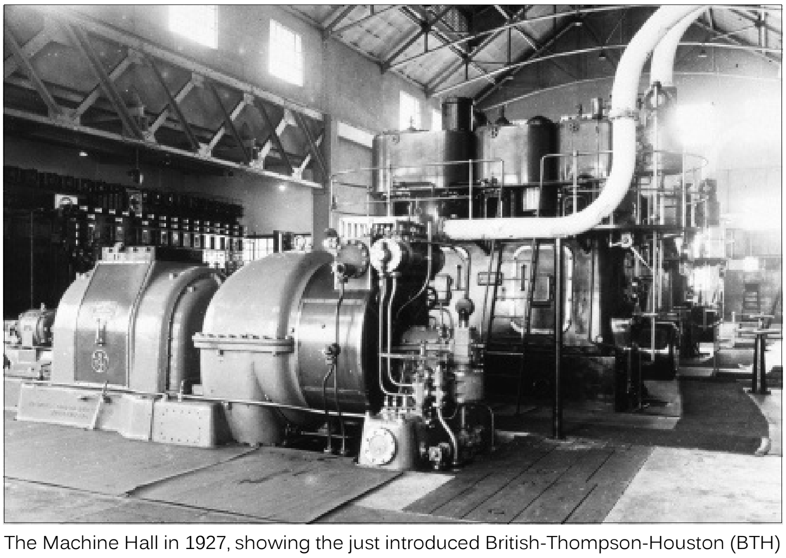
Keith Baker -- EHA Chair.

Introduction from the Engineering Heritage Canberra website.

Even before the site for the national capital was selected, a source of electrical power was seen as essential for the new city. By the time of the design competition for the Federal Capital in April-May 1911, the Director- General of Works, Colonel Percy Owen, had already selected the present Kingston site as the place for an electricity generation plant. The key advantage of the Kingston site was its proximity to a planned gauging weir on the Molonglo River just where it was joined by Spring Creek. The weir's backwater would provide essential cooling water for the steam condensers.

In June 1911 the Department of Home Affairs commissioned F W Clements, Chief Engineer and General Manager of the Melbourne Electric Supply Company to advise on the design of a steam power station for Canberra. The design provided 3 phase, 5 kV distribution for a maximum load of 25,000 persons. The Department constructed the building from 1912. After dry-pressed shale bricks disintegrated, unreinforced concrete was used for the walls. Distribution of electricity began in August 1915.

Kingston Power Station in 1926 – viewed from the north.
From the Museum of Australian Democracy website.

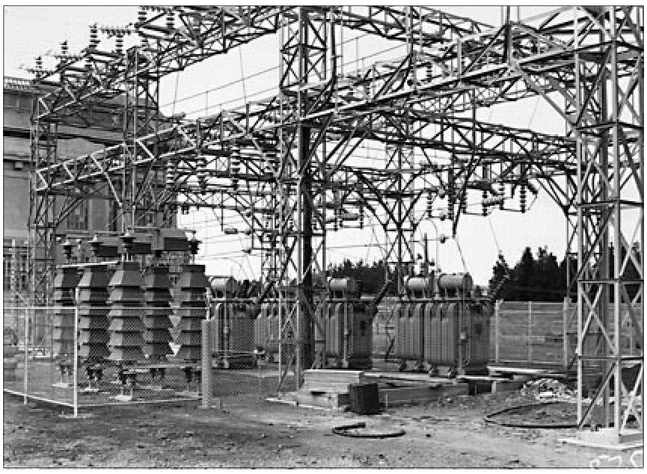


The Machine Hall in 1927, showing the just introduced British-Thompson-Houston (BTH) Curtis 1500 kW turbo-alternator in the foreground and the Bellis & Morcom steam engines behind it.. From the Australian National Archives.

Power was provided by two Bellis and Morcom triple expansion engines coupled to Brush alternators of 600kW each. A single Robey-Hall twin cylinder steam engine driving a 150kW alternator was used for periods of very light loads. Total cost of the station including the plant was £76,861.

Power from the new hydro-electric plant at Burrinjuck Dam near Yass was delivered to Canberra in 1929, but the Kingston station continued to be used intermittently until 1957. All machinery was sold for scrap in 1965.

Today, the original building and its environs are government-owned and heritage listed. The building has been redeveloped as the Canberra Glassworks.



The switchyard & transformers at Kingston PS installed in 1929 for the 66 kV hydro power supply from Burrinjuck Dam.
From the Museum of Australian Democracy website.

From the Chair – Rededication of the Kingston Powerhouse.

The Kingston Powerhouse in the ACT celebrated its 100th birthday in June and at the risk of appearing a parochial Canberran, I am devoting my column to it. The Powerhouse first supplied electricity to the developing national capital mid-1915. As was briefly mentioned in the June edition, the building was adapted to become the Canberra Glassworks and it also celebrated 8 years in its new artistic role.

In 1998 Engineering Heritage Australia recognised the significance of the building and its remaining industrial fittings with a plaque as an Engineering Heritage Marker. The plaque was later removed for safekeeping while the adaptive reuse project was underway and it languished in storage for almost a decade. Then on the very chilly morning of 21st June 2015 the plaque was reinstalled with a ceremony of rededication, attended by members and friends of Engineering Heritage Canberra and the Canberra Glassworks.

Neil Greet, President of Canberra Division of Engineers Australia, speaks to the gathering at the marker rededication ceremony.
Photo from Lynton Tilbrook, Chair, Engineering Heritage Canberra.

Social Significance is not always obvious

The retained coal hoppers hang above the Glass Hot-Shop in the former Boiler House of the Kingston Powerhouse. Photo: Keith Baker.

Clearly the building and original spaces within it which have been preserved, have significance for their architecture, their original fabric and for the way they enable understanding of their former use. The high volume of what was a hot and dusty Boiler Room has been appropriately reused as the glass hot shop, with the coal hoppers which formerly fed the boilers retained overhead.

Although the boilers were removed for scrap in the 1960s along with the generating plant in the adjacent Machine Hall, there is a life sized photo of one of the reciprocating steam engines and alternator on the wall, albeit where the high voltage switchgear had been, and interpretive panels help to tell the story. The Machine Hall has become home to less heat intensive glass blowing and mosaic work while the Economiser Room and chimney base display the finished contemporary art glass in galleries and a retail area.

Former Machine Hall, converted to the Mosaic Glass Work Studio. Note the life-size picture of one of the reciprocating steam engines and alternator in the background.
Photo Keith Baker.

The ash bin, conveyor & chutes. Photo Keith Baker

Outside, the elevated ash bin attached to the end of the Boiler House stands majestically (or maybe like a huge elephant with conveyor for a trunk and ash chute tusks). The former rail tracks on which coal was conveyed are interpreted safely in the pavement below.

All of this is clear evidence of the heritage of a physical powerhouse that was once important for the electricity it generated to supply a growing city. But how many people would have given a passing thought to the pipe bend that protrudes from the wall below the Ash Bunker when they attended the centenary celebrations, or the rededication of the plaque, when they admired the artistry in glass or enjoyed a burger at the café.

For the Powerhouse was once the hub of activity in early Canberra, where fire brigade and ambulance and telephone access and time keeping all came together, as well as being a magnet for social and competitive swimming in a heated pool.

Glass furnace Hot Shop in the former Boilerhouse. Photo Keith Baker.

Cooling water pipe from the condensers. Photo KB

What is not obvious is the fact that the humble pipe through the wall connected the condenser pit of the Powerhouse with the adjacent Molonglo River, so that the cooling water that condensed the exhaust steam from the generating plant also heated the water in the pond that had been created behind a small weir.

[*See weir, pool & terraced seating below – Photo from the National Archives.*]

This resulted in an attractive semi-natural pool with an extending swimming season for Canberra residents. Early photos show rows of terraced seating along the edge of the pool so that participants and spectators could enjoy the sport.

As I mentioned, there are interpretive panels inside the building but an opportunity remains to better interpret the less tangible social significance of this industrial part of Canberra's heritage, focussed on the remaining physical evidence of an unpretentious cooling water pipe projecting through the wall.

Keith Baker, Chair,
Engineering Heritage Australia

References

The nomination for the Power Station is at: https://www.engineersaustralia.org.au/portal/system/files/engineering-heritage-australia/nomination-title/Kingston_Power_Station_Nomination.pdf

The Power Station on Canberra's Engineering Heritage website is at: http://www.engineer.org.au/kingston_power_station.html

Hobart's Wonderful Floating Bridge

A 3-pin arch, floating on its side, carried traffic across the Derwent.

Introduction

When Lt. Governor Collins sailed up the Derwent, and established Hobart Town on the western shore of the Derwent Estuary, he had no idea that transport access to the eastern shore would become such an over-riding concern 100 years later.

Crossing the Derwent Estuary at Hobart originally involved man-powered boats, a hazardous exercise in rough weather. In 1855 the steam-powered twin-hull vessel Kangaroo was introduced, to be followed in 1927 by the vehicular ferry Lurgurena and a fleet of passenger ferries. There were several early proposals for bridging the Derwent, mostly located near Risdon, across the river from Glenorchy, and several kilometres upstream of Hobart, where the estuary is narrower, but still nearly a kilometre wide. The estuary downstream at Hobart is both wider (about 1.4 kilometres) and deeper than at Risdon, and those features presented a significant challenge to bridge engineers.

In 1824 Lieutenant Jacobs proposed a military floating bridge consisting of a long line of boats, anchored both upstream and downstream, with a timber deck spanning between them and a movable section which would allow ships to pass through. In 1926 L.Ennis of Dorman Long, working on the Sydney Harbour Bridge, suggested a transporter bridge, similar to one over the Tees River near his company's works at Middlesbrough in England.

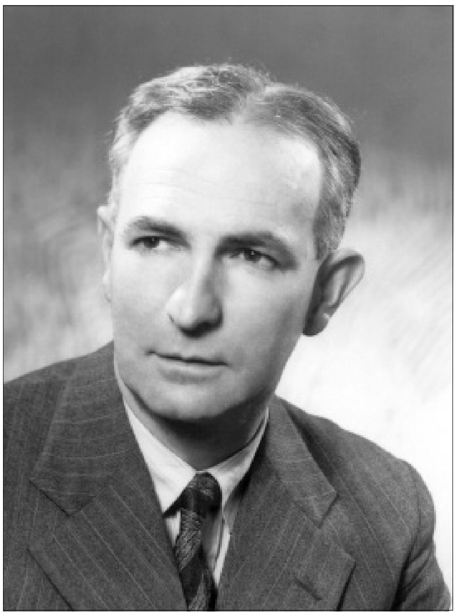
In 1930, JS Williams of Hobart proposed a straight concrete floating bridge of normal anchored design, i.e. anchored upstream and downstream on the riverbed to prevent bending. In 1934 C T Stevens of the NSW Government was seconded to Tasmania and he recommended a low level steel truss bridge with a bascule opening for ships, but upstream at the Risdon Ferry site.

SS Kangaroo carrying 4 horses and waggons across the Derwent to Hobart circa 1913..
Photo: EW Searle Collection, NLA

The Break Through

The 1930 floating concrete bridge idea was the first affordable concept. Such bridges elsewhere were straight structures. Sideways pressures from winds, tides and currents were prevented from bending straight bridges by a series of midstream anchors both upstream and downstream. However trial anchors in the Derwent proved unreliable due to the great depth of water (down to 30m) and deep soft mud below that. A brilliant local engineer came up with the first structurally feasible and affordable idea.

That engineer was Alan Knight, who became one of Tasmania's greatest engineers. He had joined the Tasmanian Public Works Department in 1932 as a bridge design engineer. He developed composite bridges in which the concrete deck is anchored to the supporting steel beams to give additional strength at less cost, a hugely successful design. Four years later, at the age of only 26 he was appointed Chief Engineer of the Public Works Department.



Engineer Alan Knight in 1946
Photo: Compliments of Hydro Tasmania

His idea was to design the bridge as a three-pin arch, but this arch would be lying on its side and floating on the water. Its apex would point upstream so that it would be strong as an arch in compression when the tide flowed out and strong in tension (like a suspension bridge) when the tidal flow was upstream. With strong pins (or hinges) at the abutments and the centre, the bridge would be able to resist incoming tides without the need for midstream anchors and could allow for the 2 metre rise and fall of the tides.

The floating bridge lift span opens for a tiny boat (bottom left) going downstream.. Note the operator's hut & the road deck sloping down from the land side (west) to the pontoon (east). Date & source unknown.

However a bridge floating on the water allowed no passage for ships, or even small boats, and much of Tasmania's industrial infrastructure lay upstream from Hobart, so a lift span would have to be incorporated. The Government was also planning another, more conventional bridge, for road and rail, much further upstream at Bridgewater. But it too would need a lift span, so in 1937 Alan Knight travelled to the USA to investigate bridge lift spans for river traffic.

The lift span he designed for the floating bridge would consist of two steel towers 150 feet (45 metres) high with concrete counterweights travelling up and down inside the towers to balance the 350 ton lift span suspended between them. The navigation opening through the lift span was 180 feet (55m) wide and 145 feet (44m) high with room for some pretty big ships.

It was decided to place the lift span at the western shore, which presumably was expected to have sound rock foundations at less depth than the east shore.. The western tower foundation consisted of four cylindrical columns built inside open circular concrete caissons 2.1m and 2.7m in diameter, one under each leg. Heavy concrete beams tied the four columns together at the tower base level.

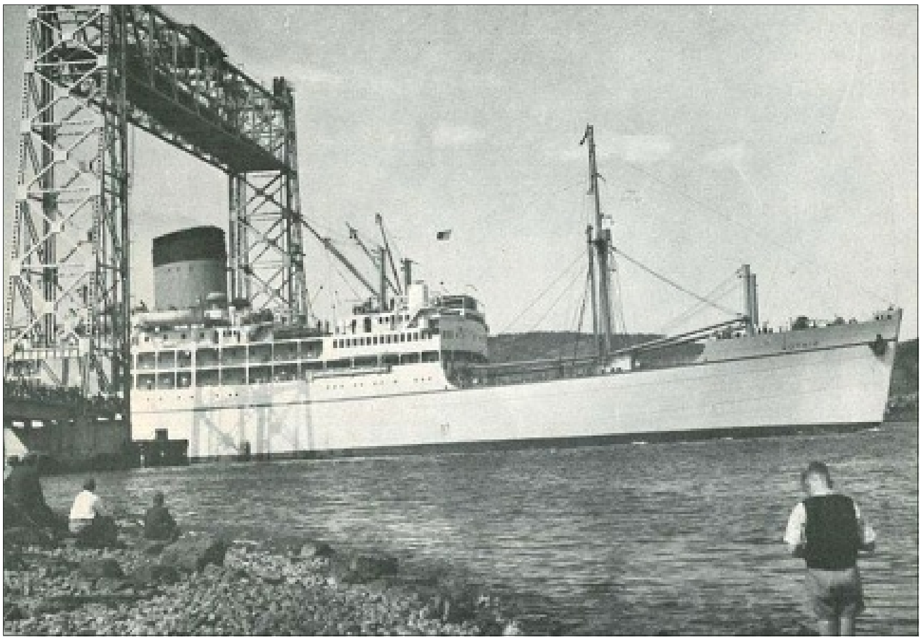
For the eastern tower, further out into the river, the builders had to take two 13 feet diameter cylindrical sheet pile caissons down 120 feet (37 metres) below river surface level before they found a decent rock base. The caissons were filled with concrete 'up to the top level of the mud' and a 10.6 x 14.8 metre rectangular concrete pier was built on top of that, presumably in clear water, for the tower base.

This pier acting as footing for the east tower was also designed to become the abutment for the west end of the floating bridge, and although both tower and floating arch have long gone, the pier and abutment are still there, out in the river and visible from the shore.

The two towers and the lift span had to be completed and ready to be open for river traffic before the remainder of the river could be blocked by the floating arch.

The lift system was electrically operated by two 37 kW (50hp) motors and raising the lift span took less than 2 minutes. There were also auxiliary petrol engines in case of power failure. The bridge operators sitting in a small hut on top of the lift span gave ships priority over road traffic.

Some dredging of the ship channel was required; the excavated material was dumped into ancient timber hopper barges which *sank with heart-breaking regularity so that salvage became a routine operation after every heavy blow.*

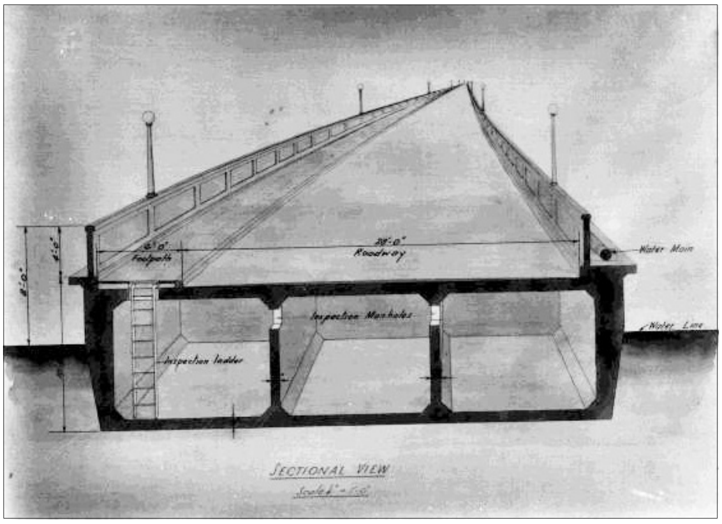


The Royal Liner Gothic visited Hobart in 1953.
Photo from The Story of Two Bridges, Platypus Publications Pty Ltd.

The actual floating bridge consisted of 24 reinforced concrete pontoons, joined in two groups of 12 to form two horizontally curved half arches each 480 metres long, joined together in the middle of the river with a huge pin joint. Hinged on/off ramps would connect the roadway to the pontoons which rose and fell with the tide.

Pontoons were built at Pavilion Point on the western shore. Each pontoon was 40m long, 11m wide, 3.6m deep and weighed about 1,000 tonnes. Internal concrete partitions supported the floor, walls and roadway, and provided 12 watertight compartments. The three open compartments at each end were sealed with temporary bulkheads to provide full buoyancy until the pontoons were joined.

On completion a pontoon was launched sideways down a timber slipway into the river. Each launch was a spectacular event which attracted public attention. After launching, the pontoons were towed across to the eastern shore and upstream to the shelter of Geilston Bay, chosen because its shoreline would match the completed curve of the half arches.



Typical pontoon cross-section. From the Colin Bennison Collection.

Launching a pontoon. From the Tasmanian Archive & Heritage Office.

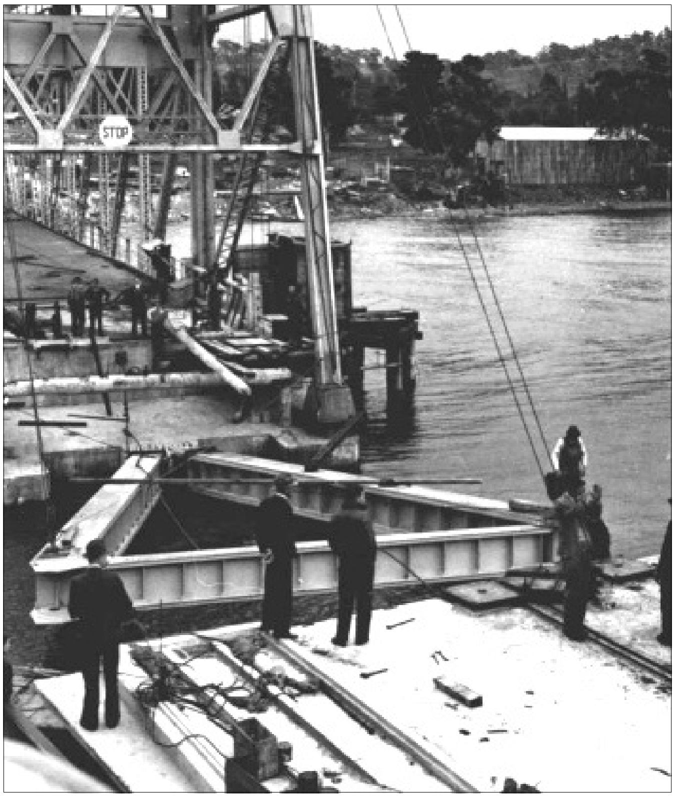
The pontoons then had to be joined together into the two half arches of 12 pontoons each, while they floated in Geilston Bay. The ends of the pontoons were designed for joining on the water. They featured steel reinforcement protruding from the concrete and a concrete lip across the bottom and up both sides. When two pontoons were brought together, a strip of sponge rubber placed by divers between the lips was compressed and formed a watertight seal. The space between the temporary bulkheads was then pumped out so that the reinforcement could be welded and concrete placed.

But spare a thought for surveyor Charles Knight who had to ensure that the pontoons were accurately aligned in the correct final curve and levelled, while his survey instruments were standing on a floating base. Steel girders fixed across the joins ensured that the pontoons matched at roadway level, and heaps of sand were shovelled to positions to achieve a level draft.

The two completed half arches parked in Geilston Bay. One of them is ready to be towed out into the river and moored to a buoy located where the apex of the arch would be. From the Tasmanian Archives & Heritage Office.

Installing the Floating Arches

Installing the two curved segments across the river required considerable planning and coordination. In preparation for placing the two 480m long arches across the river, a large buoy was securely anchored at mid-river. Steam-driven donkey engines were fixed on the pontoon decks to drive winches. As no tugs were available, a motley flotilla of eight steam vessels was assembled: the vehicular ferry Lurgurena (which the bridge replaced); two Navy mine sweepers; four river steamers; and a hopper barge. All the captains were carefully briefed and systems of communications and signals established. On 20th October 1943, with calm weather predicted, one arch was towed out on a falling tide and its midstream end was attached to the buoy. Operations were directed by Alan Knight. Next morning the second arch was similarly positioned. Both half arches were then streaming downstream from the buoy, like two hands with palms facing. The next step was to tow the shore end of one arch in to the western abutment where, with the help of the ships and various winches, the connecting pins were successfully inserted. The operation was then repeated for the other half.



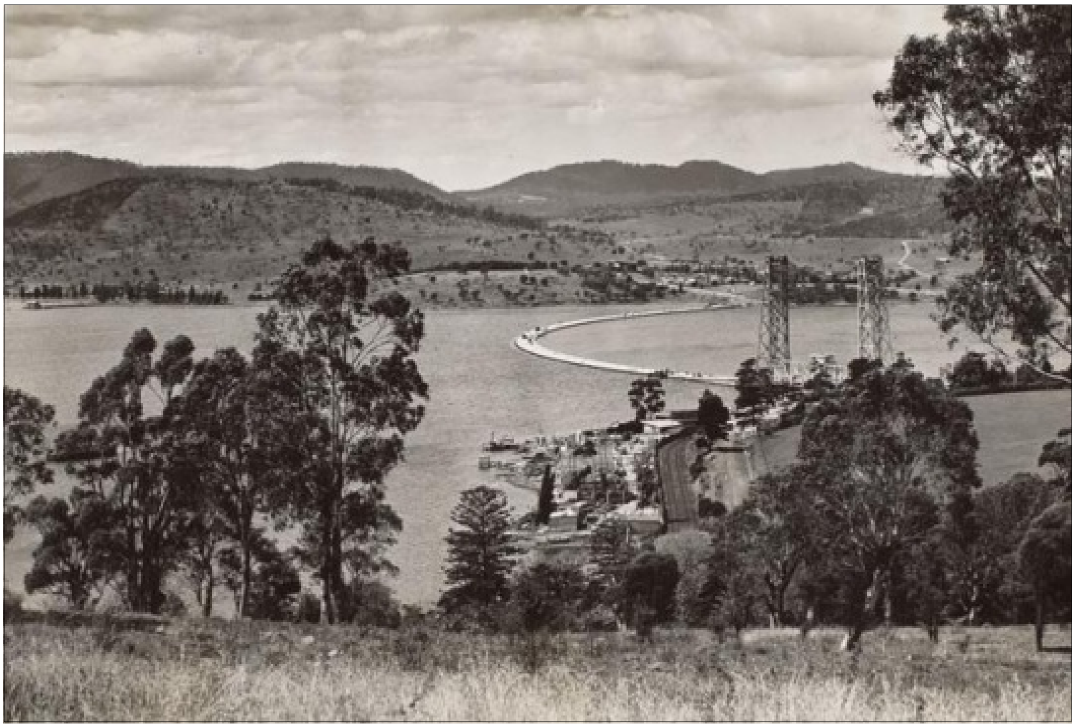
Connecting the triangular hinge frame to the concrete pontoon at the western abutment of the bridge (next to the lift span). Source unknown.

To cater for the tidal range of 2m, hinges were required at each end of the floating bridge, and the shore side pontoon ends were constructed with additional buoyancy to carry the extra weight of the connecting frame. The hinged frame was triangular in plan view, with two horizontal-pin hinges at the pontoon end and one horizontal-pin hinge and a vertical pin at its apex, to accommodate vertical and rotational movements.

Each hinge was bolted to the end pontoon with 50mm diameter steel bolts. Steel was difficult to obtain in wartime, and the contractor bought up all the 50mm rod that he could find. Some of the material was wrought iron and was rejected as unsuitable, but some of it unfortunately slipped through (see below). The connections between the hinges and the steel frame were arranged so that heavy steel pins could be lowered through matching holes once the end pontoon was in exactly the right position. On completion the hinged frames were hidden under roadway on/off ramps.

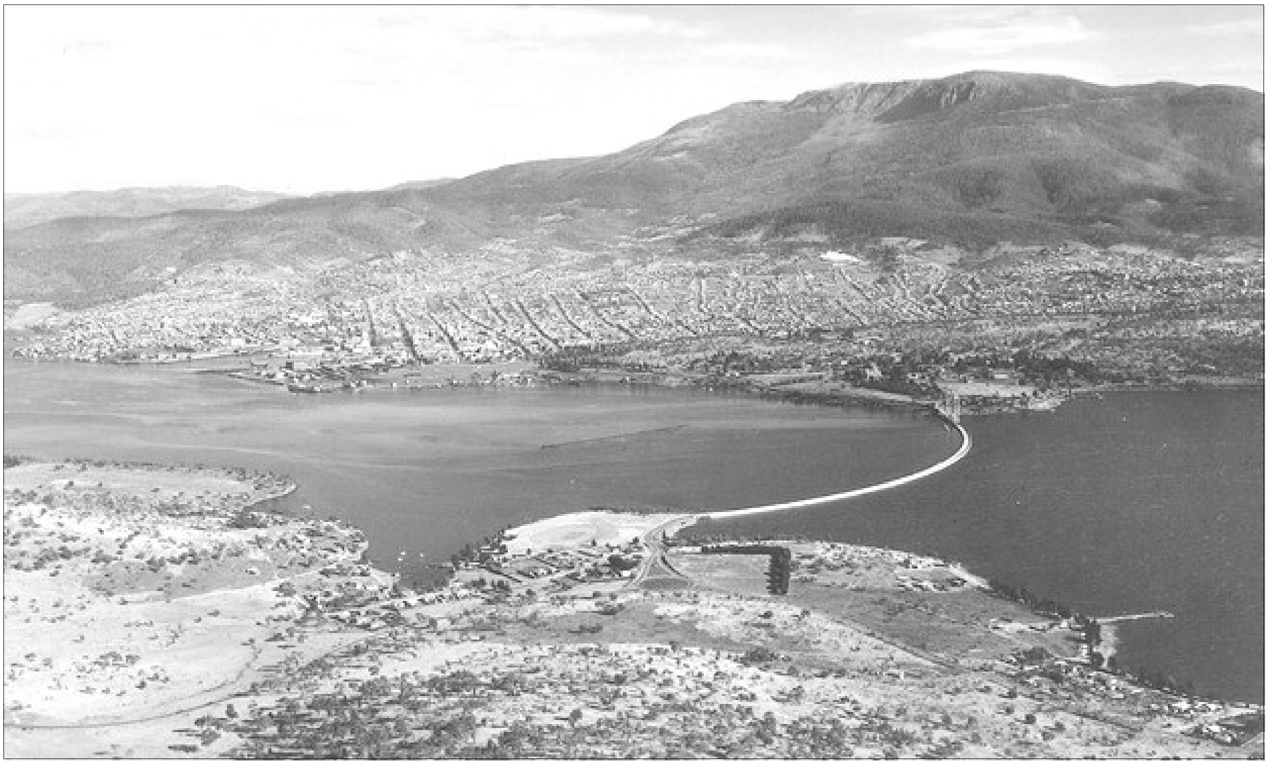
The centre pin holding the two half-arches together about to be installed.
Tasmanian Archive & Heritage Odffice

The two mid-span ends were then brought together and the connection made with a single vertical pin through matching holes. That pin was 330 mm diameter and weighed half a tonne. With that difficult task successfully completed, the final steps were to construct the on/off ramps at each end, finish off the road deck, and to build parapets along both sides of the bridge.



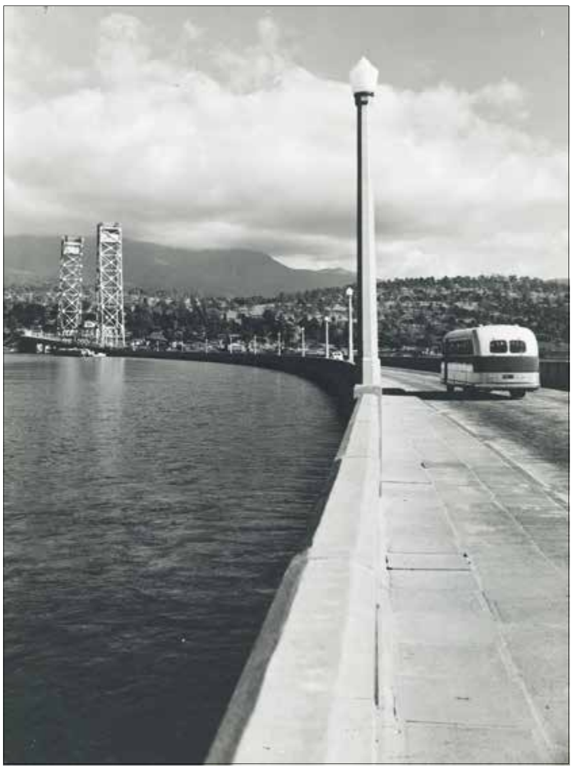
Left: The bridge nearing completion in 1943 with the works area including a concrete batching plant, steel fabrication shop and a slipway for launching pontoons in the foreground of the picture.

From: the Tasmanian Archive & Heritage Office



The floating bridge, viewed from Rosny Hill on the eastern shore, looking across to Hobart, probably in the 1950s.
From the Tasmanian Archive & Heritage Office.

Government legislation approving construction of a floating bridge was passed in 1936. The Hobart Bridge Co was formed to organise construction of the bridge – financed by shareholders, many of whom had an eye on rapid land appreciation on the eastern shore. From 1936, after two years of investigation and design, a contract for construction of the bridge was awarded for £310,000 in 1938 – in recent terms, an amazingly short time for such a complex and innovative project. The contractors established a comprehensive works area at Pavilion Point near the western abutment of the bridge, and they began work in April 1938. Unfortunately, after three years work, the contractor became insolvent and withdrew in July 1941, due in part to unforeseen problems with the foundations of a lift-span tower.



!950s view of the bridge looking west. Tas Archive & Heritage.

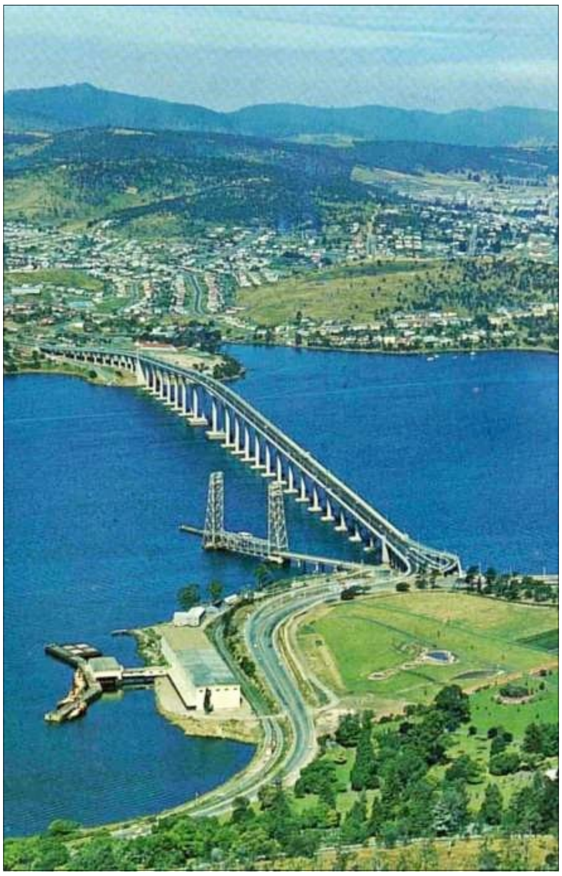
Storms & heavy seas lashed the floating bridge occasionally. This photo possibly from 1953. The Story of Two Bridges, Platypus Publications Pty Ltd.

The Hobart Bridge Company then became responsible for completing the work, probably with assistance from the Public Works Department's workforce. Apart from what seem to have been a few minor glitches along the way, the work proceeded smoothly to practical completion, until the 4th of December 1943, when a huge storm caused some damage to the parapets and almost broke the hinge at the western shore away from its pontoon. Four of the ten bolts holding the pontoon to the hinge snapped under rapid fluctuations of stress at the connection. Later tests showed the broken bolts were wrought iron, instead of the specified mild steel.

Hobart's Floating Bridge — Working Life

Despite the storm damage, the bridge was declared safe and opened to traffic on schedule on 22 December 1943, just in time for the Christmas holidays. The days of long queues waiting for the next crossing of the vehicular ferry Lurgurena were over. Vehicles using the bridge had to pay a toll, and this probably caused fairly substantial queues at times, but the toll was removed a few years later. Severe storms in 1953 and 1963 caused the bridge to be closed for a few hours, but apart from such rare occasions, the bridge served the public well for 21 years.

In some ways, the bridge became the agent of its own demise. Improved access to the eastern shore caused a rapid growth in population, when small settlements and towns on 'the other side' became large suburbs of Hobart and generated traffic volumes exceeding the capacity of the two lane floating bridge. Plans for a replacement to the floating bridge began about 1955. The replacement was the four lane Tasman Bridge immediately downstream, a multi-span high level structure under which ships could pass without disrupting the traffic flow. The day after the new bridge was opened in August 1964, the floating bridge was separated into its two halves. After years of discussion about whether further use could be made of the pontoons, one sixth was towed to Bruny Island to be a jetty at Alonnah and most of the remainder was sunk in deep water in Storm Bay. The lift span was removed and its steel towers demolished.



All that remains of the floating bridge are the lift span & towers, soon after the Tasman Bridge was opened in 1964.
Image: Bruce Cole & Allen Wilson Floating Bridge presentation.

Remembering the Floating Bridge

A few years ago, members of Engineering Heritage Tasmania were becoming concerned that this innovative and unusual bridge, which had been so important to the development of Hobart, was falling out of living memory. They decided to do something to remedy this. Bruce Cole and Allen Wilson produced an excellent paper on the subject which was presented at the Engineering Heritage Australia Conference in Hobart in 2011, and in 2013 Bruce Cole, then Chair of Engineering Heritage Tasmania, started preparing a nomination for a National Engineering Heritage Recognition Award.

This was a rather unusual nomination, being for an object that no longer exists, but he had the full support of his colleagues and Engineers Australia and, in the event, of the Minister for Infrastructure in the Tasmanian Government, of the local governments on either side of the river (Cities of Hobart & Clarence), and the Governor of Tasmania, Her Excellency Professor the Honourable Kate Warner AM, who unveiled two replicas of the interpretation panels and markers at the ceremony held off-site at the Rosny Barn near east end of the bridge, on 5th May 2015.

Bruce Cole near the EA interpretation panel & marker at the east abutment of the former floating bridge. Tasman Bridge in the background. Photo: Richard Jupe

The ceremony sparked memories of travelling over the bridge for some there. *Clarence Mayor Doug Chipman said he remembered driving across the bridge to school every day. "Some days it was pretty calm and no problem at all," he said. "But occasionally you'd get the really strong southerlies coming up and the waves would come over the top and cars would get covered with spray, and panels were taken out and the bridge was really rocking, so it was quite a traumatic journey". He said the link between east and west had a big impact on Hobart and its residents. "The period of the floating bridge was remarkable in terms of the growth in Clarence [on Hobart's eastern shore]," he said. "The population grew from 5,000 by a factor of six to 30,000 people just over a space of 21 years. "In that time there was a huge amount of infrastructure to be built, so it was an enormous boost".* [1]

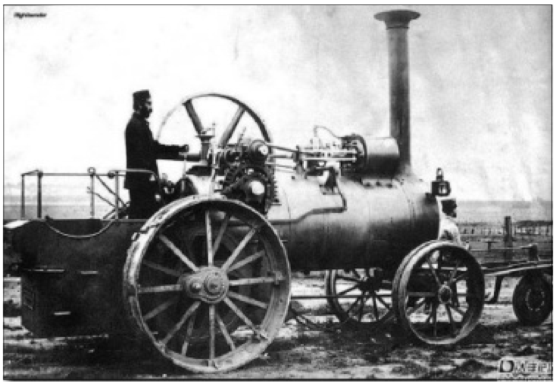
References: *This story was put together from a number of sources, nearly all written by Bruce Cole or by Allen Wilson and Bruce Cole. Allen Wilson is a retired Divisional Engineer, Tasmanian Dept. of Main Roads. Most of the historical information in this nomination and many of the photographs have been researched and collected by Allen Wilson over many years. He is a recipient of EHA's Award of Merit for his contribution to the conservation of our engineering heritage.*

From the Editor

1 http://www.abc.net.au/news/2015-05-05/hobart-floating-bridge-declared-national-heritage-marker/6446520

Celebrating 150 years of mechanised transport in Tasmania

Five steam engines take part in a road-run from Bellerive to Glenorchy.
From Chris Martin – owner of the 1910 Salisbury Steam Roller.



The first mechanised transport to appear in Tasmania was an Aveling & Porter steam traction engine (at left), imported from England in 1865 by Mr Askin Morrison, a well-known businessman of Hobart in that era. Morrison was also the owner of the SS Kangaroo, shown in the previous story about Hobart's Floating Bridge.

The road-run in this picture story happened on Sunday July 19th this year, exactly 150 years from the date proposed for the Grand Public Trial of Morrison's Traction Engine along the Clarence Road (or Street) in 1865. Five steam engines took part in the 2015 run. The run started from the Blundstone Arena in Bellerive on the eastern shore of the Derwent, travelled north, under the approaches to the Tasman Bridge, through Lindisfarne, Risdon, and across the Bowen Bridge to Glenorchy.

But half the fun seems to have happened the day before. On Saturday 18th, three engines travelled under their own steam all the way from Glenorchy to the Blundstone Arena. This story features one of those engines – Chris Martin's 105 years old Salisbury Steam Roller, the only full-sized engine to be built in Tasmania. It was built by the Salisbury Foundry to compact road pavements in Launceston, prior to laying tram tracks in 1910, and here it is – on its way to Bellerive, there, or on the way back.

Above: The Salisbury full steam ahead

Left: Wood tender in attendance?

Right: Escort vehicles wait on, while Salisbury pauses for an oil fill.

Below: While Salisbury has paused for an oil fill, the 10 hp 1928 Robey "Road Locomotive" takes advantage and roars past!

Note: Chris Martin was the recipient of the Engineers Australia John Monash Medal in 2011. Details on the Engineers Australia website.

All photos, apart from the Aveling & Porter, were taken by the Martin family, and/or their drone. I hope they will forgive me if I get the photos in the wrong order. Local readers will no doubt be able to identify the locations and accept that this mainlander did her best. Sadly, there was no room for a map.

The Editor

Above: Salisbury roaring downhill – at 4 km/hr?

Left: Salisbury pauses (again) to top up the water tank with a borrowed garden hose.

Above: Salisbury & a 1923 Marshall Sons & Co. traction engine at the Blundstone Arena before the ceremonies.

Above: On July 19th following the speeches, the engines depart the arena about 11 am, heading back to Glenorchy.

Left: Salisbury is overtaken by Robey again! This time near Risdon Cove.

Right: On the home stretch, after a long day, the Salisbury roller crosses the Bowen Bridge over the Derwent, heading towards Glenorchy.

The Sons of Gwalia Goldmine

A very brief history & the survival of its Headframe & Steam Winder Engine

Until the 1870s the economy of Western Australia was based on wheat, meat and wool. A major change in the state's fortunes occurred in the late 1880s when gold was discovered and prospectors by the tens of thousands swarmed across the land in a desperate attempt to discover new goldfields. The first gold rush occurred in 1885 when Charles Hall discovered alluvial gold in the Kimberley area, now Hall's Creek, 2850 km north of Perth. Quickly, further alluvial finds occurred across the state, near Southern Cross west of Perth in 1887, then Cue, up north again, in 1891. Paddy Hannan's discovery at Kalgoorlie, 600 km west of Perth in 1893 and the earlier discoveries at nearby Coolgardie in 1892, sparked the serious gold fever. In many cases, the boom was short lived with towns and mines disappearing fast once the surface deposits were depleted. Only where companies developed underground mines did towns survive. The population in Western Australia in 1891 was 49,782. By 1895 it had doubled to 100,515, and by 1901 was 184,124. By 1900, more than a third of the state's population was located in the Goldfields. The political influence of this population was demonstrated when the Goldfields threatened to secede, should Western Australia not join the Australian Federation.

Left:

For those of us who are unfamiliar with WA and the distances between Perth and the Goldfields, note that Kalgoorlie is 600 km and Leonora 830 km by road from Perth.

Much of the country in the Goldfields region is semi-desert and when the gold was discovered, there were no railways closer than Northam.

Transport was via coach or horseback and packhorse, with donkey teams for heavy freight. You carried your water with you!

The railway followed the gold finds but by 1898 it had only got as far as Menzies, 100 km short of Leonora.

Gold was discovered near the base of Mount Leonora, a couple of kilometres from the town of Leonora, in May 1896 by Carlson, White and Glendinning, who named the claim "Sons of Gwalia" (sons of Wales) in honour of Thomas Tobias, a Welshman storekeeper in Coolgardie, who funded them. The new find was only one of a number of reefs opened up on the Mount Leonora district in that year, but was to prove by far the most significant. A syndicate set up by the discoverers in June 1896 registered a lease over the obvious outcrop of ore, and commenced small-scale extraction from a vertical shaft. The hole was still less than twenty feet deep when they were visited by George W. Hall, an engineer who had links with the London and Westralian Mines and Finance Agency. Hall obtained an option over the syndicate's 24 acre lease and took samples for assay. In August 1986 he offered £5,000 in cash for the property. The syndicate accepted with alacrity, for £1,000 per man was a splendid return for a few months' work. Hall, too, was content with the transaction, although even he could not have dreamed that his new reef would eventually yield gold worth over ten million pounds at the 1896 bullion price.

Hall equipped the mine with a second-hand ten head gravity stamp mill by May 1897, and began production early in June. The surface ore was rich, and the first parcels, undoubtedly hand-picked, yielded an average 2.8 oz to the ton. Hall's first month of crushing produced 2,000 ounces, recouping his entire capital investment, and from July 1897 the Sons of Gwalia was paying its own costs and earning a profit. A London based firm of engineers, Bewick, Moreing & Company, then took over the mine and sent a young American mining engineer (and future American president), Herbert Hoover, to prepare a thorough evaluation. Hoover arrived at the mine in August 1897. By that time the shaft was down to 175 feet, and several hundred feet of drives had opened up the lode.

Hoover had no doubts about the long-term value of the property, and recommended systematic extraction, and construction of a much larger treatment plant. He also had firm ideas about whose hands should control the enterprise, for in recommending acquisition of the Sons of Gwalia, he also personally demanded "entire management" of designing the mine plant. These were brave words for a twenty-three year old engineer on his first real job, but they had their effect. The Sons of Gwalia was purchased by the London and Western Australian Exploration Company Ltd on 17 November 1897, and preparations were made to float the property in London.

Hoover was then appointed general manager with the full authority to develop the mine as he saw fit. In a harsh climate, seventy miles from the railhead at Menzies, and faced with high material and labour costs, Hoover saw that his critical task was to reduce production costs by any means at his disposal. "No other lode in the world", he claimed, "presents such an array of severe conditions which must be struggled against to do cheap mining." Within days of his arrival, he calculated that he could cut production costs by a third. He increased the working hours, stopped double time on Sundays, sacked the union organisers, and reduced wages.

Herbert Hoover photographed in Perth in 1898
Source - State library of WA.

Hoover's cost cutting strategy took two main directions: to convert labour to a contract basis wherever possible, and to minimize dead work - unproductive sinking and driving in the mine. In achieving the first aim, Bewick, Moreing had been impressed with the qualities of Italian miners on other Western Australian fields, and Hoover contracted a local labour agent, Pietro Ceruti, who provided a steadily growing workforce of Italian contract miners for the Sons of Gwalia. Hoover explicitly regarded them as his allies against the union: "I have a bunch of Italians coming up this week and will put them in the mine on contract work. If they are satisfactory I will secure enough of them to hold the property in case of a general strike, and .... will reduce wages." There was no general strike, and Hoover's heavy hand continued to dominate industrial conditions, but he had also founded the Italian community which was to characterize the town of Gwalia, which grew up around the mine, for the following 65 years.

Hoover planned a radical change in the underground workings. A new incline shaft was to be sunk at 45° in the gold-bearing formation itself. Haulage was to be done by a 50 horse power Risdon winding engine over a headframe of Oregon timbers 48 feet high which incorporated an automatic ore cart tipping device, primary crusher and ore bin. Work on the new incline shaft commenced by September 1898. But Hoover, despite having become a shareholder and partner in Bewick Moreing, was not happy with the way the firm was independently drawing up plans without, in his view, consulting him adequately. Friction between Hoover and the firm increased, until Hoover left the Sons of Gwalia in November 1898 for a post in China. He was at Sons of Gwalia for little more than a year, but in that time he had achieved a great deal and had a lasting influence on the future of the mine.

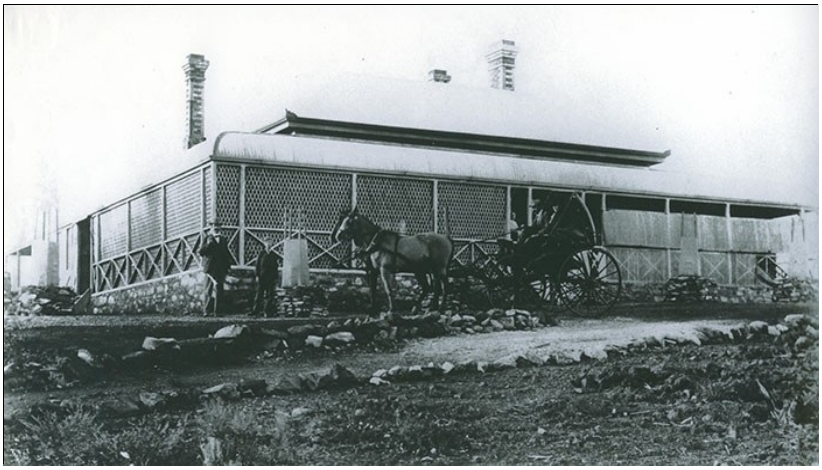
The old Sons of Gwalia Mine office – now part of the Gwalia Museum
2012 Photo – Source Gwalia Museum

Very little on the Sons of Gwalia mine site today dates from Hoover's term as General Manager. The headframe, winder and mill were not even commenced when he left. Probably the brick mine office and assay office were built, and the manager's residence was under construction. Nevertheless the plant that rose in the following year was substantially Hoover's, and the methods of mining and milling which he devised were those which carried the mine through its prosperous first decade. Probably his most important legacy was the low cost of production he achieved. His final report as manager showed the cost per ton, even without the new plant, to be 24 shillings & 4 pence, just 7% over the pound he had aimed at. Hoover claimed this was the lowest working cost of any Western Australian mine.

A town site was laid out at Leonora in 1897, in what seemed a position central to the new mining district. Within a year the town had three hotels, two banks, a telegraph office, a hospital, Mechanics' Institute, and enough private shops to anchor it permanently in position. However, most of the local mines died, while the Sons of Gwalia, 4 km south of the town, steadily grew to employ a workforce of 500 during 1899. As Leonora was inconveniently distant, the majority of the mine workers pitched their tents on the company's leases, and the community divided into defacto twin towns, Leonora and Gwalia, which survive to the present. In order to attract the miners to the businesses of Leonora, the Municipal Council established a steam tram service between the towns in 1903, and converted it to electric operation in 1908.

The former Assay office at the Sons of Gwalia Gold Mine – now part of the Gwalia Museum. Photo - source, Gwalia Museum

Because the town of Gwalia offered only leasehold plots, there was little incentive to set up business there. The mine management built in brick, but the miners survived in timber framed, galvanised-iron-clad huts in primitive conditions, no sanitary facilities and the only water had to be carried from condensers at the mine. Not much else was built except, in 1903, the Mines Department built Western Australia's first State Hotel there. Designed by Perth architect William E. Robertson, the two-storey brick hotel was by far the most imposing building of the town.



Sons of Gwalia Mine Manager's House in 1902, now known as Hoover House. Note the two-horse Phaeton rig in the foreground. Photo source – Gwalia Museum

Despite pressure to squeeze out non-British labour, with means such as language tests, in the early 20th Century a large proportion of the underground miners were Italians, and their numbers were maintained by the company providing English lessons. In 1917 a Government official visiting the State Hotel observed: *The trade is practically confined to Italians. I hardly saw an Englishman on the premises, and during my stay I saw only one drunkard – and he an Englishman.* Single men among the Italian miners tended to congregate in a makeshift encampment on the leases, while immigrant families lived in the town of Gwalia. Leonora remained the "British" town. It is evident that both ethnic and social division existed to maintain the two distinct communities over many decades.

Gold production in the Sons of Gwalia reached its first peak in 1903, with over 50 tonnes of gold produced annually, and the company was in steady production from 1900 until 1910, but there were emerging technical problems which would worsen with the passage of time. There were problems with the power supply and productivity reduced as the ore-body grew more distant from the shaft. The winder engine broke down in May 1911 when it was hauling ten miners in a skip, which then ran away to the shaft bottom. Three of those aboard were killed.

In 1913 the Risdon engine was replaced by a Fraser & Chalmers engine, rated at 1,000 hp and capable of hauling at 1,500 feet per minute. The headframe was raised in height to 62 feet. Underground, horse traction was introduced to cut haulage costs along the drives. With its incline shaft just short of 4,000 feet in length, the Sons of Gwalia was in 1919 the deepest mine in Western Australia, and yet probably the most economical in operation.

Two disasters beset the Sons of Gwalia management in January 1921. The Burnside industrial award came into effect, raising the labour component of production costs by 30%. A fire destroyed much of the surface plant. Dedicated effort by the company staff saved the headframe and winder. The disaster allowed the company to dismiss almost its entire workforce, dramatically cutting expenditure for nearly three years. The effect on the Gwalia community was devastating. Practically the entire workforce - about 400 men - were dismissed. The Mines Department came to the rescue, and provided sustenance payments of three pounds a week to the workers.

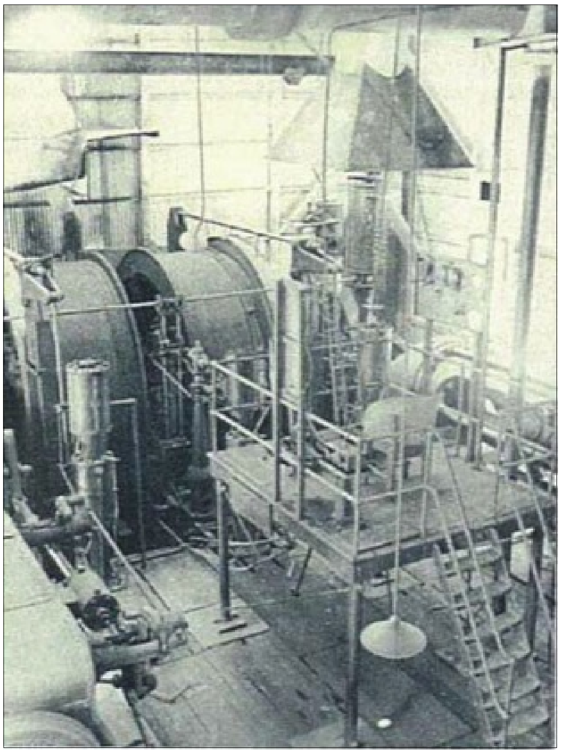
The Gwalia State Hotel. From the Shire of Leonora Collection

Recovery was slow, production and the price of gold were down. The company had no incentive to expand in the circumstances, and instead, began to talk of closing down. Production gradually fell to reach a first low in the late 1920s. At that point, Western Australia was almost the only state in Australia to still produce gold. In 1928 the State Government advanced the company £78,000 to be spent on equipment and to finance underground development. Meanwhile that year, Herbert Hoover was elected president of the United States. The injection of money led to vigorous development. Diamond drilling was resumed, and the incline shaft was sunk below 4,000 feet.

Then in 1931 came the miracle: the gold price rise. It is an economic paradox that the gold industry prospers in times of depression. The Sons of Gwalia's decade of misery was over. The 1930s years of prosperity brought major re-investment in bigger and more efficient surface plant. These investments were timely, for they were to carry the company through the lean years that lay ahead. The war brought labour shortages, exacerbated by the internment in 1940 of the Italian nationals amongst the workforce. Production fell sharply. Despite this a swimming pool was constructed on Tower Street in 1942, overlooking the mine, and provided both a welcome community facility and a good store of water for fire fighting.

The end of the war did not ease the labour shortage and labour was becoming more expensive. Production and the gold price were again down. In 1948 the company made a loss for the first time since 1929. The dividend of 1950 was the last the shareholders were to receive. Throughout the 1950s State government loans kept the mining operating, but there was little prospect of repayment, as the mine barely paid its production costs each year. In 1968 an announcement was made that the mine would close on New Year's Eve. An accident intervened on 27 December and the mine was finished. The Sons of Gwalia went into receivership. Over 65 years the mine had produced 2.5 million ounces of gold, provided employment to thousands of workers and was a significant contributor to the State's economy.

The Gwalia Headframe 2012. Photo: Martin Silk, Intelara Consultants.



The Fraser & Chalmers Winding Engine at Gwalia in 1963. From the Shire of Leonora Collection.

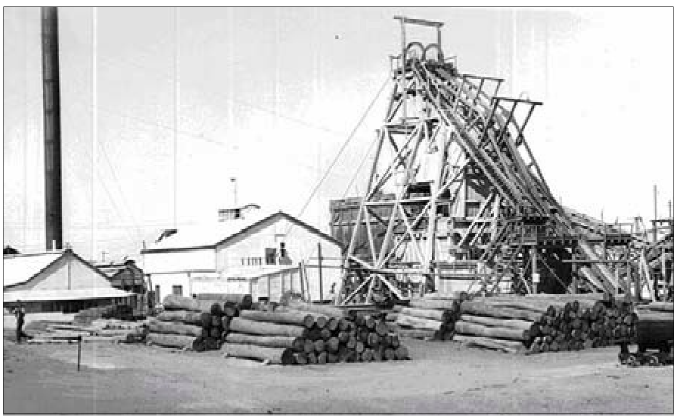
In 1970, geologist Don Reid and his wife Donna came to live in the mine manager's house. Together with another geologist, David Quick and his wife Linda, they established a museum in the former mine office. The Reids had begun collecting soon after their arrival and the museum was opened in May 1972. It comprised six rooms and the verandah of the former mines office 'recording the history, activities, ingenuity, working and social lives of the residents of Gwalia and Leonora'. Besides the mines office, the museum's collection now includes the assay building, the mine superintendent's house, many artefacts associated with the mine such as skips, kilns, and gold bar moulds and, more recently, the original timber headframe and the 1912 Fraser & Chalmers steam winding engine.

The headframe was to be demolished in the 1970s, assessed as being unsafe. Action by the museum's curators ensured that it was fenced instead. It was threatened again when the price of gold rose in the 1980's. A new company, Sons of Gwalia NL was established and open cut operations commenced on the site of the former underground mine. When the open pit was to be expanded the steam winding engine and the headframe, along with its tipping ramp, ore bin and primary crusher, were moved in 1987 and re-erected a short distance away at the museum, in correct proximity to each other.

Timber headframes are now very rare in Australia, only 5 are known to still exist. Three of these are in WA, the Sons of Gwalia one being the oldest. It is the only large incline headframe in the country, and one of very few large timber headframes from the 19th century still in existence world-wide. The 1912 Fraser and Chalmers winder engine is the largest of its type in Australia and one of only three surviving. It is a fine example of a large, steam-powered winding machine and a good example of the technological achievement of its period.

WA State Heritage Office lists several buildings in the Gwalia Museum Group on the State Heritage Register, but does not include the re-located head frame, winding engine & winder house. However they are included on the Leonora Shire heritage inventory, and have been since 1998. Engineering Heritage WA nominated the Sons of Gwalia headframe & winding engine for an award under the terms of Engineering Australia's Heritage Recognition Programme in October 2014. An Engineering Heritage National Marker was awarded on 31st May 2015.

This story was condensed from the nomination of the headframe & winder engine for Engineering Heritage Recognition. The nomination was prepared by Ian Maitland, Chair of Engineering Heritage WA. *The Editor*



The Sons of Gwalia mine site, circa 1930s. From the Shire of Leonora Collection

EHA Centenary Book Project

"Wonders will never cease" will be the title of the book proposed by Engineering Heritage Australia to commemorate the centenary of Engineers Australia in 2019. The book will feature 100 stories of Australian engineering achievements with an emphasis on maximising reader interest and providing an elegant mixture of text, images and graphics in large landscape format in colour. Most subjects will be described on two pages.

The book is not intended to be a 'catalogue' of significant engineering sites and items in Australia and is therefore not intended to be inclusive either across states and territories or over time. It will include subjects from before European Settlement up to the present and also look into the future. A small team has been working on the project for several years and has proposed a preliminary list of 100 subjects, selected according to:

- their benefit to Australian society
- their engineering content and likely interest of the story
- the quality of information available for inclusion
- the "wow factor" of the story

A very short description of each subject has been put together.

Work has now commenced on writing the material and collecting suitable images. However the opportunity still remains open for readers to submit new suggested subjects. Keep in mind, however that each new item suggested will be assessed against those already on the list. If you have any ideas or suggestions for us, please forward them to eha@engineersaustralia.org.au .

Bruce Cole, Chair, EHA Centenary Book Committee.

A suggested front cover for the book. Image/design – Richard Venus

The full list of proposed subjects should appear on the Engineers Australia website by the time you receive this magazine. Find it at: https://www.engineersaustralia.org.au/engineering-heritage-australia under "Centenary Book Project". This web page will also set out how you can make suggestions for additions to the list if you do have any ideas.

The list of Australian engineering achievements is categorised under ten themes or headings as follows: Water & Waste; Energy; Connection; Structures; Sea & Air; Communications; Manufacturing; Resources; Defence; Technology. A few examples are given below, with their very short descriptions – and maybe an extra note or two. *The Editor.*

Communications: Left

Alf Traeger's Pedal Radio: put the Outback in touch with the Flying Doctor.

Photo from the National Library of Australia shows Alf Traegar using bicycle pedals to operate his pedal generator and radio, photographed by John Flynn when it was unveiled in Adelaide.

Water & Waste: Right.

Chaffey Irrigation, in Mildura and Renmark: the beginning of irrigated farming in Australia.

Aerial photo from Excitations – Mildura Photographers.

Technology: Left

Cochlear Hearing Implant: enabling the profoundly deaf to hear.

Photo from ears2hear

Energy: Right

Tasmanian Hydro-electric schemes: world-class engineering delivering renewable energy since 1916

Photo © Peter Mathew, courtesy Hydro Tasmania.

Sea & Air: Left

Black Box Flight Recorder: adopted world-wide, has saved countless lives [by identifying the causes of many accidents].

Photo from the Air Transport Safety Board shows a Modern Cockpit Voice Recorder – part of a Black Box Flight recorder system.

Water & Waste: Right

WA Goldfields Water Supply: pumped clean water 750 km inland to safeguard and develop mining communities in 1904

Laying the Goldfields Water Supply pipeline – Perth to Kalgoorlie. This pipeline had steel Lock Bar pipes, then a new Australian pipe-jointing invention. Photo from the National Trust of Australia, WA.

Structures: left

Sydney Opera House: clever engineering enabled the architect's vision to be built.

Photo: Owen Peake

Structures: Right

Sydney Harbour Bridge: engineers gave Australia an internationally recognised icon.

Photo: Owen Peake.

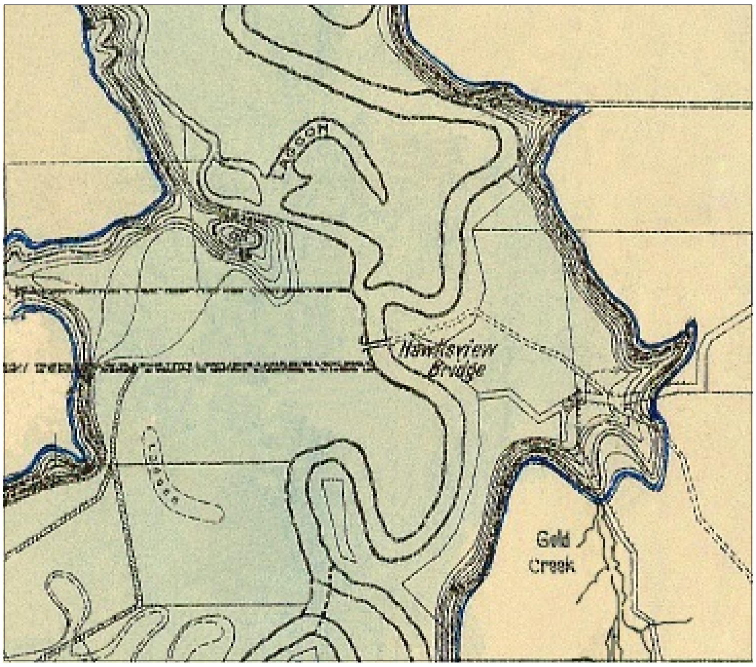
Energy: Left

Snowy Mountains Hydro-electric Scheme: providing electricity and irrigation to three states.

Photo shows the opening of Tumut No.1 Power Station – from International Conservation Services P/L, Sydney.

The Hawksview Bridge

over the Murray River at Gold Creek in Talgarno, Victoria



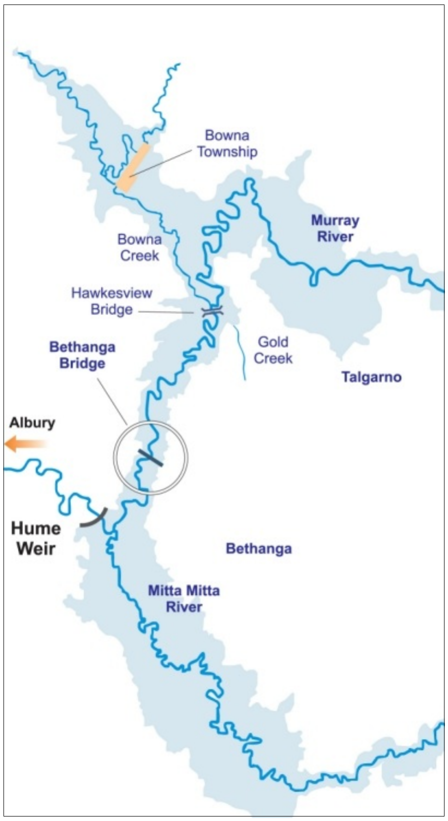
Detail from the 1922 contour plan for the Hume Reservoir produced by the NSW Water Conservation & Irrigation Commission. Shows Gold Creek, the winding course of the Murray River and Hawksview Bridge.

After years of lobbying, settlers of the Talgarno district on the Murray River in north-eastern Victoria were finally offered a bridge across the Murray in 1891. They had successfully argued against the cheaper option of a punt, pointing out that this form of crossing was unsuitable for stock.

Talgarno had been leased as a cattle station in 1848 and by 1856 John Hore was running 3000 head. In December that year, some alluvial gold was discovered in the local Ruby and Gold creeks but the Melbourne Age described it as "nothing very striking". More promising were later discoveries in 1870 and a reef, the "New Year's Gift", was struck in Bethanga on 1 January 1876. By June there were some 400 miners at work, some of them returning to the old Talgarno diggings at Ruby and Gold Creeks.

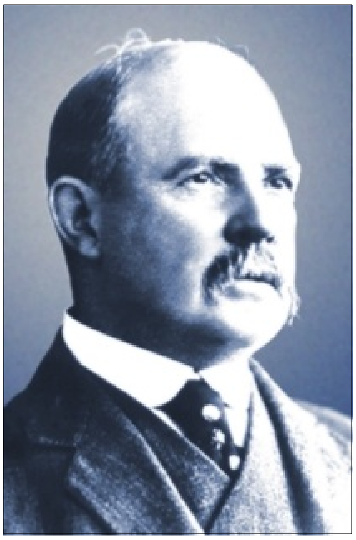
As the reef was mined, significant deposits of copper were discovered and there was talk, for a while, that Bethanga would become the Burra of Victoria. However, both metals proved difficult to extract and, despite significant investment in plant and equipment, the field was never successfully developed.

Grazing on the rich alluvial soils of the river banks was a more successful and reliable pursuit in what had become known as the Upper Murray District, on both sides of the river as far as Jingellic and Tintaldra. Stock, both cattle and sheep, were brought down from New South Wales to the Murray for fattening and then sent back across the river to market in Albury or Wodonga. The output of cattle alone in 1891 was estimated at up to 20,000 head a year.



Key locations around the Hawksview Bridge.
Map drawn by Richard Venus.

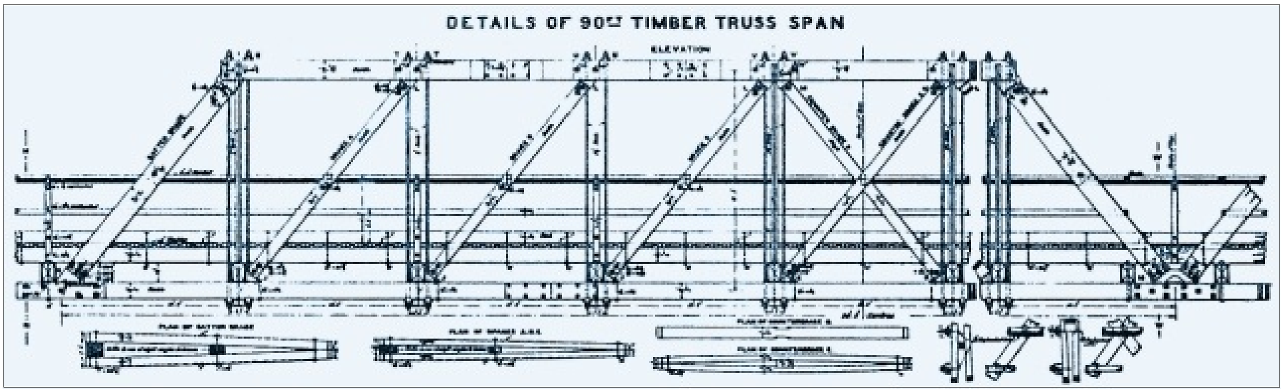
However, the Murray was only fordable in the dry summer months and this inevitably led to calls for a permanent crossing in the district. In September 1891, the New South Wales examiner of Public Works, Harry Gilliat, heard evidence from local farmers and graziers. The preferred location for a bridge was on Hawksview station at a crossing place known as the Gold Creek ford. This was on almost a direct line between Talgarno and Albury and would reduce the distance travelled by seven miles. A bridge would also provide access to markets for the butter and cheese produced in the district as well as allowing residents to purchase cheaper goods across the river in Albury.



Gilliat was convinced. He delivered his report in March 1892, saying that the evidence was "sufficient to warrant the construction of the bridge". All that remained now was for the respective governments to come up with the funds. Three years earlier they had each agreed to contribute £400 towards the cost of a punt: a bridge would cost £3000. New South Wales agreed to provide its half and proceeded to acquire land for the road to Albury. On the Victorian side there was some discussion about the preferred site but it was finally accepted that the one at Gold Creek had the most advantages.

The bridge would be of timber and built to a new design developed by Percy Allan (at left), a young engineer in the NSW Public Works Department (PWD). With a need to provide transport across the large area of the colony, the PWD had turned to timber truss bridges rather than more expensive masonry or iron structures.

Allan had access to reliable data about the strength of Australian hardwoods and, in 1890, was able to design a more efficient bridge which was cheaper to build and maintain. The average saving was about 20% and a wider roadway could also be provided. The PWD adopted two standard Allan truss designs, one for 70 foot and one for 90 foot spans.

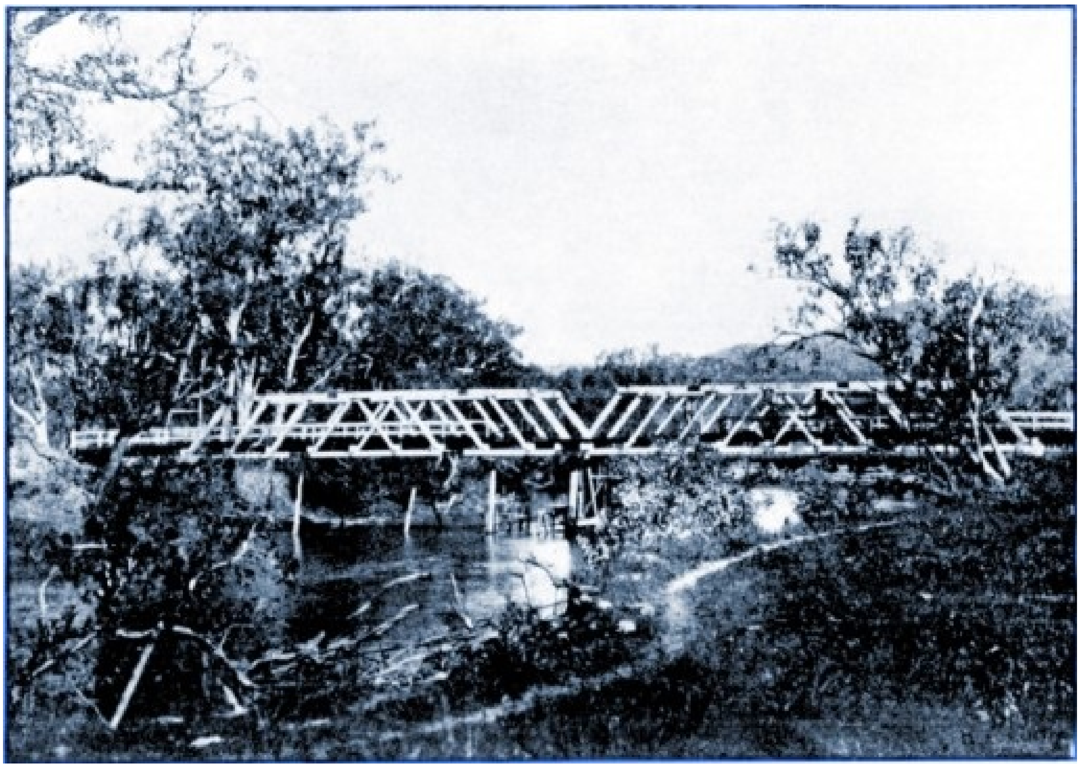


Half elevation of a 90 foot Allan timber truss bridge copied from a paper presented by Percy Allan to the Royal Society of NSW in 1895.

The bridge at Hawksview would have two of the 90-foot spans with two 30-foot approach spans which required 5,500 feet of timber and 16 tons of ironwork. R H Roberts, jnr, of Moonee Ponds was the contractor and the price of £1751 1s 4d was significantly less than the original estimate of £3000, demonstrating the economy of Allan's design.

The bridge was erected under the supervision of William Burrow, CE, the government engineer (or project manager). Burrow had to commute from Wagga where he was also supervising the construction of another timber truss bridge designed by Allan. This was the first of an improved design which could span 110 feet. This latter bridge was opened on 12th November 1895 and named the Hampden Bridge. It served the community and thousands of travellers through Wagga, as part of the Olympic Highway for one hundred years exactly, was converted to local traffic only, and then sadly, after much toing and froing and bitter arguments, it was demolished in August last year.

The Upper Murray bridge was formally opened on 26 April 1895: John Pooley, president of the Towong Shire Council, broke a bottle of wine upon one of the stanchions and christened the structure the "Talgarno Bridge". Local residents were delighted: William Ferguson – who had long campaigned for the bridge – said that, ten years ago, to get across the river he had to take off his necktie and swim! The official guests then retired to the Talgarno Athenaeum for a banquet and the inevitable speeches and then danced until dawn. Despite the christening, the bridge almost immediately became known as the Hawksview Bridge.



The Hawksview Bridge soon after its completion, photographed by W A Neal of Jindera, near Albury.
From the Australian Town & Country Journal, 6th April 1895, page 33.

THE HAWKSVIEW BRIDGE.

ALBURY, SUNDAY.

A communication has been received from Mr. Craven, M.L.A., from Benambra, that the bridge over the Murray at Hawksview will probably be soon constructed, as money has been provided for it in the Victorian estimates, and tenders will be called as soon as New South Wales makes similar provision. The bridge will divert a great deal of the Upper Murray traffic to Albury, as the new route will considerably shorten the road distance of Talgarno, Bethanga, Walwa and Tintaldra from this town.

OPENING OF THE HAWKSVIEW BRIDGE.

[FROM THE ALBURY BANNER.]

A number of local residents, with visitors from Albury and the Upper Murray, assembled at the Gold Creek Crossing on Friday afternoon, at the opening of the new bridge over the Murray. In the absence of the Minister for Works, the opening ceremony was performed by Mr. John Pooley, president of the Towong Shire Council, on the centre of the bridge.

These two cuttings demonstrate how swiftly the NSW view of the bridge prevailed over the favoured local name "Talgarno Bridge".
Left: The Age, 23rd October 1893
Righ t: Ovens & Murray Advertiser, 11th May 1895.

There was a lot of talk about the benefits to the district of cooperation and mutual interest but Federation was still some years away and a customs post had to be established between the colonies. The customs house was built on the New South Wales side and the officer was appointed by Victoria, although empowered to act for both jurisdictions.

The sturdy bridge might still be standing had it not been for the decision to dam the Murray and create one of the world's largest water storage schemes with a capacity six times that of Sydney Harbour. Once again the communities on either side of the river would be separated.

In 1916, Les Sambell CE, the Towong Shire engineer, expressed the community's concern about the loss of the fertile river flats – "some of it the best in the State" – and suggested that the Hawksview bridge "would be a suitable base for submarines".

In the end, when the dam was built and Lake Hume created, a replacement, the Bethanga bridge, was provided for the Hawksview Bridge and it was another truss structure designed by Percy Allan's Department – but this time with nine spans made of steel and standing a hundred feet above the floor of the river valley.

Richard Venus 21 September 2015

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Addendum – from the Editor

Richard Venus' interest in what I referred to as the Gold Creek Bridge (aka Talgarno Bridge & Hawksview Bridge) was sparked by his reading of the Engineering Heritage Nomination for the later Bethanga Bridge (see above). In it I quoted several passages from W H Ferguson's book *Doomed Talgarno,*[2] including: *From 1841 until 1896 the residents wishing to go direct to Albury had to ford the Murray at Gold Creek, or to cross in a small row boat, and make their horses swim across the stream. In the late "eighties" the residents of Talgarno began to agitate for a bridge, and to the great joy of all in the district, a bridge was built.* WH Ferguson also tells of the flock of 200 maiden merino ewes, bought by my Great Grandmother, from James Mitchell of Tabletop in 1881 for their farm *Craigielea* on the Gold Creek. Uncle Will and his neighbours, the Drummonds, had to catch each sheep, tie its legs together, dump it into a little row boat, and row it across the river. I hope they had a good dog! It's no wonder they fought long and hard for that bridge, and no wonder they were all devastated when the Hume Reservoir was to be built. They were not only going to lose their bridge, but many would lose the best bits of their farms., and some, like Uncle Will, would lose their houses and sheds and gardens and yards as well.

1 An Engineering Heritage Recognition Ceremony for the Bethanga Bridge was held at the bridge (NSW side) on 10th October 2015.

2 WH Ferguson was my much loved Great-uncle Will, an eminent geologist, surveyor & discoverer of dinosaur fossils, & also a farmer at Talgarno.

Engineering Heritage of Hong Kong
The Peak Tram and the City Trams

In March and June this year we brought you stories from Brian McGrath about the Tai Tam Waterworks Heritage Trail in Hong Kong and the Hong Kong Museum of Coastal Defence which he visited last November on an 11-day holiday in Hong Kong. He obviously had a very busy time during this holiday, because in this issue we have another Hong Kong story from Brian, this time about trams – first the Peak Tram which was opened in 1888 as a funicular railway, then a few notes about the ordinary, everyday electric trams down in the City, which first operated in 1904. *The Editor*

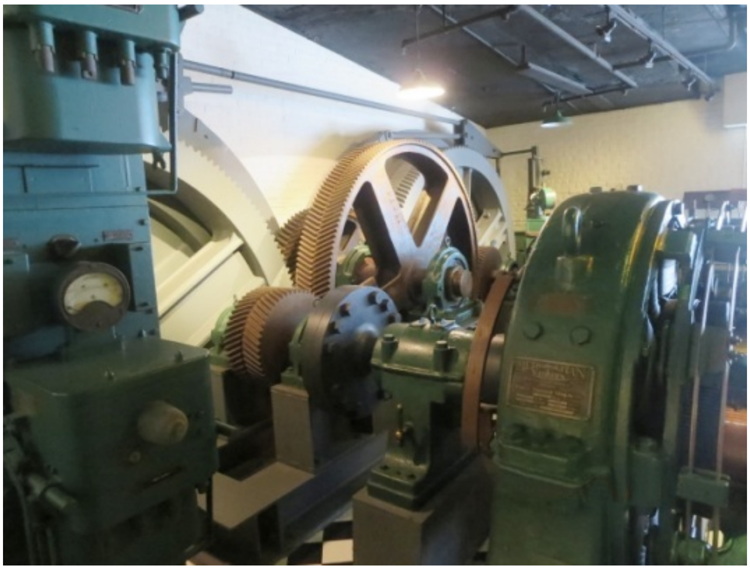
The Peak Tram

This rather smoggy (and frankly terrifying) view from The Peak gives some idea of the Tram's climb. Photo: Brian McGrath.

The Peak Tram is one of the most popular tourist attractions in Hong Kong. Thousands of passengers every day ride it to Victoria Peak (the station is 396m above sea level; the highest elevation of The Peak is 522m) to take in a wide vista of Hong Kong Island and Kowloon. (Although on each of the three occasions I visited The Peak, the view was severely impacted by the ever-present smog).

A Scotsman, Alexander Findlay Smith came to Hong Kong in 1866 aged 22. He had previously worked on the Scotland Highland Railway, and in 1881 he convinced the Hong Kong Governor that a funicular railway should be built to The Peak. At that time, transport up the steep track to The Peak was by sedan chair. The tram service opened in 1888, the first funicular railway built in Asia. Smith was probably motivated by commercial reasons; he invested in a hotel and property on The Peak.

Sedan Chair on the Peak Road. Photo: thepeak.com.hk



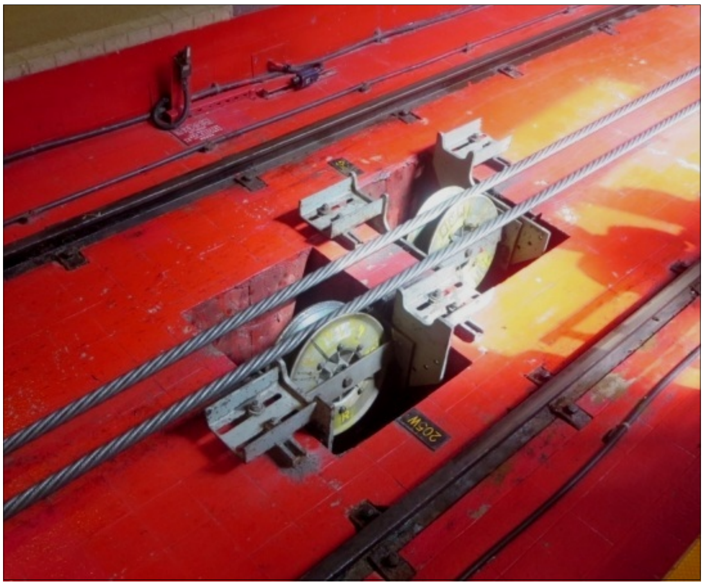
An early Metropolitan Vickers engine in a Haulage Room display at the lower terminus of the Peak Tramway. Photo: Brian McGrath

There are 4 intermediate stops on the line at Barker, May, Macdonald and Kennedy Roads. The original tram was of wooden construction, with all the seats facing uphill; the uphill-facing seats are retained to this day.

The Haulage Room is located in the Upper Terminus Building. Originally the motive power was supplied by coal-fired steam boilers, driving a steam-powered winding engine, but from 1926, an electrically powered haulage system replaced steam power. The supplier of the original winding engine is unknown, but Metropolitan Vickers supplied the electrically powered system.

Garden Road Lower Terminus – the tramcar is out of sight around the curve. In the distance, the row of tilted rollers locate the cable when the tramcar is in the station. Photo: Brian McGrath

The 1500m long 50mm dia. cables are wound on twin 3.5m dia. drums and run over cable rollers installed between the rails just above the track bed. The cable is renewed every 5 years.



Two sets of cables pass over rollers at the top terminus. One cable reels out the down tram while the other cable pulls the up car. Note the large size of the rollers compared with the shadow of a person on the platform.. Roller locations can be adjusted horizontally in two directions. Photo: Brian McGrath

The cable for the down car (between the rails) is seen from behind the up car at an intermediate station. Empty rollers for the up car cable are visible outside the station. Photo: Brian McGrath

A Peak Tram arrives at the Upper Terminus, with tram travellers waiting to board for the downward journey. Photo: Brian McGrath.

All-metal tramcars were introduced post WWII. The current tramcars are of aluminium construction, feature the latest micro-processor control systems and can carry 120 passengers. The service runs at 10 minute intervals. There is a small historical display at the Lower Terminus and brochures detailing the history, and some engineering details of the Tramway are available at the Upper Terminus.

Left: An original wooden Peak Tramcar at the Garden Rd (lower) terminus in 1890. Photo: Wikipedia

Right: A Peak Tramcar from 1956, on display near the station at the upper terminus. Photo: Brian McGrath.

Hong Kong – The City Trams

The Hong Kong city tramway was the second public transport system in Hong Kong after the Peak Tram, and it was an electric tram system right from the start in 1904. Unlike many city tramways around the world, it appears to have flourished from the start, and continued to do so (except for an hiatus during the Japanese occupation).

The first section of single line track was built along the north shore of Hong Kong Island from Kennedy Town in the west to Causeway Bay, and later almost doubled in length to the east end of the north shore at Shau Kei Wan, a distance of 13km. In the tramway's earliest days, single-deck trams were sourced from Britain. Open-top double-decker trams replaced them from 1912, and these were changed to enclosed top decks in 1925.

The Eastern terminus at Shau Kei Wan, and a departing tram. Photo: Brian McGrath

Since then, there has been a constant programme of modernisation of the rolling stock and changes in suppliers. Remarkably, the first trams were either 1st or 3rd class, with very different seat layouts. The first double deckers had 1st class on the top deck and half of the lower deck.

In 1949 the single track was replaced with double tracks, dispensing with passing loops, and single deck trailers were introduced in 1965. But the class system persisted – the trailers were 1st class – until the class distinctions and the trailers disappeared in 1972.

From Brian McGrath, PSM

No.7 tram at North Point, Hong Kong Island
Photo: B McGrath

Extra References: *Various Wikipedia sites, including Hong Kong Tramways, Veolia Transport (the present owners), the Peak Tram and the Peak Tram History. Also see www.thepeak.com.hk/*

The tram stop & a departing tram at Sai Wan Ho. Note how tall & narrow the tram appears compared to the bus alongside it. No speeding around corners! Photo: Brian McGrath

Notes & Queries

Professor Harry Messel – a Commemoration

Professor Harry Messel died on the 8th of July 2015, at the age of 93. He was Professor of Physics at Sydney University from 1952 until 1987. I know he wasn't an engineer, but he was probably the most famous scientist in Australia for many, many years, and his work was of extraordinary importance to most engineers – particularly that relating to the development of computers. Robyn Williams of the ABC Radio National Science Show is quoted in the Australian Science Media Centre website http://www.smc.org.au/expert-reaction-death-of-harry-messel/ as follows:

Harry was a force of nature: a wonderfully bombastic voice I can't believe has finally been silenced. He was of Ukrainian parents, brought up in Canada (not USA as many assumed) and he famously pioneered private money for Australian Science. He once bailed up Sir Frank Packer, the newspaper mogul, demanding funds. "What's in it for me?" asked Packer. "Nothing" replied Harry. "Ok the cheques in the post" snarled Packer. And it was. Harry hired the best physicists, he brought the computer, the size of two buses, to Sydney University, he set up the Summer Schools for teachers and students, and he brought out the huge blue books of science for school kids. But it was that voice, speaking up for Australian research, that boomed for 50 years. He was recognised with the medal of the Australian Academy of Science last year for his extraordinary contributions to our scientific culture.

There are many reminiscences of Harry on the same site, and an obituary of him in the Sydney Morning Herald at: http://www.smh.com.au/comment/obituaries/emeritus-professor-harry-messel-championed-scientific-research-and-education-20150715-gici7q.html
But perhaps the best piece is the ABC Science Show – *The most famous Scientist in Australia Saturday 5th September 2015* – at: http://www.abc.net.au/radionational/programs/scienceshow/the-most-famous-scientist-in-australia3f/6740878#transcript and other ABC programs about Messel can be found on the web.

From the Editor – Enjoy!

A query about the Peak Tram in Hong Kong

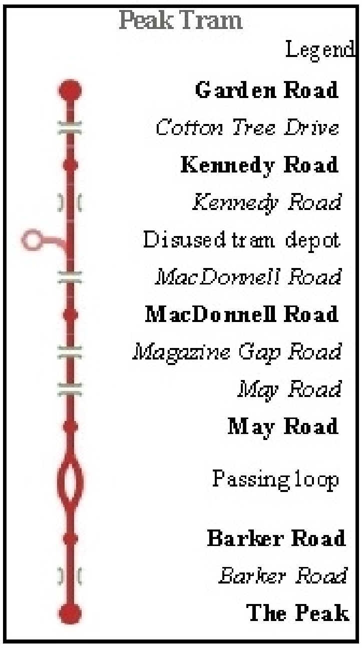
The brilliant 1897 photo on from https://en.wikipedia.org/wiki/Peak_Tram (bottom left) shows vividly the wild country the tram originally passed through, and the ups and downs of the line. It also shows, in the distance, a passing loop with two trams. If this line was a true funicular, defined as *a railway (especially one on a mountainside) operating by cable with ascending & descending cars counterbalanced*, it would necessarily have a passing loop in the middle of the line, and it would have a single long cable loop with a wheel at the top, or (say) two cables wound in opposite directions on two connected winch drums, so that as the drums rotate, one cable winds in while the other winds out.

However, on the same web-page as the photo, there is a diagram of the tram route (right) showing the tram stations (**bold**), and road underpasses or overbridges (*italics*), with the passing loop ¾ of the way to the top. If this diagram is correct, the Peak Tram is not a true funicular, but a cable railway with two separate winches hauling the two tram cars independently. In this arrangement, the passing loop could be anywhere along the route. Can any reader confirm whether this is correct? Or could the diagram be nowhere near to scale, and the loop is actually in the middle of the line? The photo appears to have been taken from the MacDonnell Rd station looking south across two over-bridges towards the loop, and it appears to conform well with the diagram.

Brian McGrath told me that one of the plaques in a haulage room states:
Throughout its history, the haulage room has been located in the upper terminus building. From 1888 until 1926 the system was operated by a steam-powered winding engine, its impressive 3.5 metre drums hauled a steel rope along cable rollers installed between the main rails above the track bed. . . . . . . Through a system of bell signals sent from the tram, the controller [at the upper terminus] adjusted the power input which wound and unwound the 1500 metres of steel rope. . . . . As the twin drums turned in unison, the counterbalanced tram cars started and stopped simultaneously, crossing each other at exactly the same location on every trip.

That plaque describes the situation until 1926 – but what happened after 1926? Did the system only operate as a true funicular until then? Was it only built from the Peak down to MacDonnell Rd station and then extended after 1926?

The Editor



Connections

Just a Reminder

The 18^{th} Australian Engineering Heritage Conference
From the Past to the Future
7^{th} – 9^{th} December 2015
in Newcastle NSW

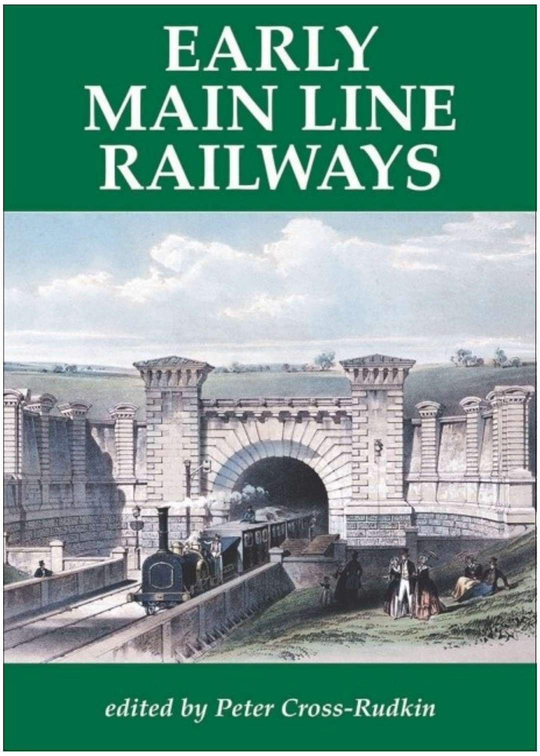
Read all about the conference at
http://www.engineersaustralia.org.au/heritage-2015
Plenty of information there about the pre-conference tour, the venue, accommodation, registration, and the program.

Early Main Line Railways [1]

This UK conference volume explores the world-wide expansion of railways.

Papers from the first Early Main Line Railways conference will be published in the coming spring[2]. The book will examine the all-important years when railways first developed routes and networks and became major contributors to economic growth around the world, made possible by rapid advancements in civil and mechanical engineering techniques.

The book will form a companion volume to the well-established Early Railways series but the scope will be wider, encompassing not only the technical obstacles which were overcome but also the social, legal, cultural, economic and business interests of railways.



For example, Mark Casson questions whether the way in which railways in Victorian England were promoted was an engineering triumph or a waste of capital. David Hodgkins balances the influences of monopoly and competing railways and the part played by George Carr Glyn, a giant in the financial sector of railway development. Railways in Egypt and India are explored by several authors and the differing roles of professional groups in the establishment of railways in Britain is the subject of another paper. Railways in the Americas are discussed in three papers and aspects of European railways in another. Technology is treated by other papers, one of which discusses drawing offices in railway workshops. Another traces the development of electric locomotives.

The start date for this series of conferences was the opening of the Liverpool & Manchester Railway in 1830, with a cut-off date of 1870 in the UK and possibly later for other countries. Future conferences will be held at four-yearly intervals, alternating with the Early Railways series.

Subscribers will be able to buy the book at the discounted price of £36 and their contribution will be acknowledged in the preliminary pages. The full retail price will be £55. Postage and packing will be charged extra. The subscription list will close on 1st February 2016 and the book will published shortly after. Further details and a subscription form can be found at www.earlymainlinerailways.org.uk Alternatively, subscribers can contact the publisher, Six Martlets Publishing, at sixmartlets@uwclub.net or by post at 4 Market Hill, Clare, Suffolk CO10 8NN, UK.

The conference was sponsored by the Institution of Civil Engineers, The Newcomen Society, Beamish – the North of England Open Air Museum, the National Railway Museum and the Railway & Canal Historical Society.

The image of the Primrose Hill tunnel on the front cover is by JC Bourne 1838. The tunnel was built for the London & Birmingham Railway under the supervision of its Engineer-in-Chief, Robert Stephenson, and opened in July 1837.

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1 The first Early Main Line Railways conference was held at Caernarfon, North Wales in June 2014. The publisher expected that some readers from Oz might be interested in this book, despite the lack of papers about Australian Railways.

2 i.e. Autumn 2016 in the Southern Hemisphere.