



ENGINEERS  
AUSTRALIA

# EHA MAGAZINE



# Engineering Heritage Australia Magazine

ISSN 2206-0200 (Online)

**OCTOBER 2016**

**Volume 2 Number 4**

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Engineering Heritage Australia Magazine is published by Engineering Heritage Australia, a Centre within Engineers Australia.

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Cover Images:

Front: Image title "A Busy District, Sydney" in c.1910 – better known as Railway Square.. This image is copied from a hand coloured glass lantern slide found in the Oregon State University Archives in the USA. Image from the internet courtesy of Lindsaybridge.

Back: The "James Craig" during restoration work in Darling Harbour circa 1987  
Image: Scanned from a 6x6 slide at 6400dpi.  
Found on Wikipedia. Author: Sardaka.

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## CONTENTS

Editorial — Some thoughts on the stories in this issue	3
The Story of Barque "James Craig" by Dr Brian Martin	4
Notes & Queries – Bridge Poetry Reprised	8
Notes & Queries – Ferguson Tractors	9
Duke & Orr Dry Dock Pumphouse by Owen Peake	10
Notes & Queries – Bairnsdale to Orbost Railway	16
Trams in Australia by Miles Pierce	17
Obituary – Dr John William Connell, AM, D.Eng.	21
Obituary – Brian McGrath, PSM.	24
Review – "With Power and Purpose" by M.G. Lay	26
Connections	27

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# Editorial

Many times, the stories in this magazine raise questions or comment that can't well be dealt with in the text of the story, or in following *Notes & Queries*. The obituary of that eminent engineer Dr John Connell, AM, D.Eng., on page 21, is such an example. In the very first issue of this magazine dated December 2013, we celebrated John Connell's 100<sup>th</sup> birthday with the report of a birthday party held for him at the offices of Engineers Australia Victoria Division. I attempted to produce some sort of record of his multitude of achievements over his long and fruitful life – but I had only moderate success.

What success I did have then was down to the great assistance of Connell's old friend and colleague of very many years, Stan Johnstone. It is with great sadness that I have to record the death of Stan Johnstone in March this year, only a few months before that of his friend, colleague and mentor. Stan was a sort of guardian of the collective memories of the firm, John Connell and Associates (now known as Aurecon) and its employees. He had been putting together many records of the firm and its employees, and of John Connell himself, and collecting them in websites dedicated to the firm and the man. This promised to be an enormously important resource for the future – but it was not to be. I was told that at a time early this year, when Stan was very ill, his computer was invaded by a ransomware virus and all his files were lost and his websites destroyed, along with a trove of information about John Connell and his people.

When I set out to write the obituary of Connell I used the 100<sup>th</sup> birthday story as a starting point, but there was much more to be discovered. I want to record the valuable assistance I received from John Connell's daughter Barbara Vincent, his colleague from the 1950s for 30 years John Peyton, his successor at John Connell and Associates Jack Wynhoven, and a 1970s employee, my brother Peter Haughton. Extensive internet searches unearthed some information about the more significant contracts undertaken by the firm, but I find it remarkable that in the publicly available records of such important jobs as (say) the Melbourne Arts Centre, how many times the architect gets all the praise, while the engineer doesn't get a mention – not even his name!



Vale Stan Johnstone, March 2016.

When I wrote the 100<sup>th</sup> birthday story, I finished it with a call to action: *If Engineering Heritage Australia had a Hall of Fame, Dr John Connell, A.M., D.Eng., would have to be included, along with a list of his jobs. I think it is about time someone out there commenced a catalogue raisonné of his engineering works. There must be a few of his former colleagues who would be equipped to take on or assist with such a task.* Such a call to action hardly belongs in an obituary, but unfortunately it is still necessary. I would love to hear from anyone who is planning (for instance) a biography of the great man. It needs to be started before all those who remember him and his works have gone!

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## *The Hunting of the Image – An Agony in Countless Internet Searches.*

[with apologies to Lewis Carroll]

One of the most interesting, but frequently extremely frustrating, aspects of this editing job is finding appropriate images to illustrate the stories. This is a magazine after all, and I do like to have lots of pictures, and good ones if possible. Sometimes an author provides a bunch of photos along with the text and I only have to select the ones to use. It's best to start with twice as many pictures as will actually be chosen. Sometimes a story arrives with text alone, and I have to start the hunt myself. Unfortunately, that usually takes many hours of searching on the internet. Occasionally I can prevail on friends or acquaintances to hunt stuff out, or take photos for me, but the internet is usually my prime source.

Miles Pierce's *Trams in Australia* (see page 17) is an article that came without images, and I set out on a long search. But it wasn't at all frustrating – it was amazingly rewarding. Eventually I found images to illustrate nearly every type of tram and nearly every place Miles wrote of. It is fortunate for me that there are many passionate tram aficionados in this country, who love to put their photos online and are generous with permission to use them. I have corresponded with two of them.

Lindsaybridge provided three of the very best : – the cover picture; the brand-new t\*\*m (light rail car) at the Fish Market stop in 1997 (page 20); and the one of trams, trains, double-decker buses and many automobiles in North Sydney in the morning rush hour 1950s style (page 19). One train and three trams are all heading for the Harbour Bridge and the tunnels into the heart of the City. All that tram stuff, the tracks, the viaduct and the businesses under it had vanished by the time I moved to Sydney in 1961, but my partner remembers it well. He used to catch a tram from Mosman across the bridge to underground Wynyard every morning, and then another up George Street to Sydney University.

One would think that the circa 1910 cover picture of Railway Square in Sydney would equally show a vanished world, but not so. The row of Hansom cabs outside Central Station is now replaced by taxis and cars. The Central Station clock tower is not yet built, but the geography is unchanged. The spire of Christ Church St Lawrence is still there and the tall Marcus Clark Emporium on the corner of George & Pitt Streets is still there, now occupied by the NSW Railways Dept.

# The Barque “James Craig”

from Dr Brian Martin.



“James Craig”, a wreck in Recherche Bay, Tasmania, in 1972.  
Image: Geoff Winter

My first sighting of the *James Craig* was in 1972 when my wife Helen and I were setting off to walk from Catamaran to Port Davey on the far south coast of Tasmania. To my surprise, at Recherche Bay, we saw the elegant hull of a sailing ship aground in the Bay. It had obviously deteriorated badly and I found it difficult to imagine that what was effectively a wreck could ever be conserved, let alone be restored to sailing condition.

Fortunately I was wrong and, although it took about 30 years and 30 million dollars, I have now had the opportunity to walk her decks and sail in her.

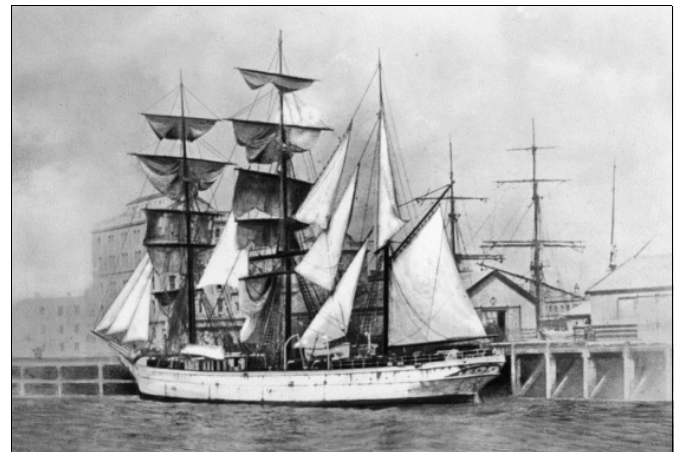
## Launching and construction

*James Craig* was launched on 18 February 1874 as the *Clan Macleod*.

She was built as an iron sailing ship by Bartram, Haswell and Company, shipbuilders of Sunderland, UK, to the order of Glasgow grain merchant and shipowner Thomas Dunlop for a cost of £11,375. She was rigged as a barque – square rigged on the fore and main masts with a spanker on her mizzen mast<sup>1</sup> – one of many such vessels constructed around this time to take advantage of the flourishing maritime trading opportunities of the day.

When *Clan Macleod* was built, wrought iron plating was common. After about 1878 steel plate, as opposed to iron, was used more commonly to clad ship hulls. The ½ inch thick plates were riveted onto iron frames and stringers. A survey stated that the iron plating was ‘well wrought [although a little rough] the workmanship is generally sound’.

The shell plating method used in her construction was the ‘sunken and raised system’ with outer iron strake plates<sup>2</sup> horizontally overlapping the inner plates. Each plate is riveted to the frames and stringers – the outer plates having a liner inserted between the frame and the plate. Vertical plate ends were butted flush and riveted with internal butt straps, thus providing a streamlined hull. Water tightness is achieved by ‘caulking’ the edges of the plates by hammering their edges to seal any gaps.



A photo of “Clan McLeod” (now “JamesCraig”) held by the Qld State Library, date unknown but likely to be 1892 or 1893, The ship was probably berthed in Brisbane. Note the gaff-rigged spanker sail, aft of the mizzen mast.



The reverse angle irons on floors and frames extended across the middle line to the hold beam stringers and gunwale alternately. There was provision for a boarded ’tween deck and a lower floor at keelson<sup>3</sup> level. Access to the hold was by one of 3 hatches: main, fore and quarter.

She had only one bulkhead reaching from the floors to the upper deck and secured between double frames. This collision bulkhead divided the forepart of the hold from the forepeak and was designed to contain in-rushing seas in the event of a bow collision.

Left: The “Clan Mcleod” photographed in New York by Alice Austen, when the ship was moored off Staten Island in circa 1891. The rigging in a large, sharp, copy of this photo is remarkably clear. The photo was probably used in the restoration work

1 A mizzen mast is the third mast from forward in a vessel having three or more masts. On a square rigged ship, the spanker is a gaff rigged fore-and-aft sail set from and aft of the aftmost mast.. – from Webster.

2 A strake plate is a continuous line of planking or plates from the stem to the stern of a ship or boat. – from Google.

3 a keelson is a longitudinal structure running above and fastened to the keel of a ship in order to stiffen and strengthen its framework. – from Webster.



## “James Craig” Specifications

Overall length 70 m

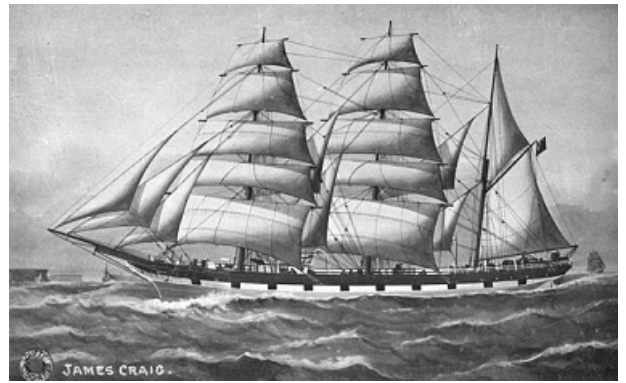
Beam 9.5 m

Displacement approx. 1500 tonnes loaded - 646 tonnes net

Masthead height 33 m above deck

Sail area 1100 m<sup>2</sup> fully rigged

It is also recorded that she has 424 plates, 50,000 rivets and 5000 metres of standing rigging.



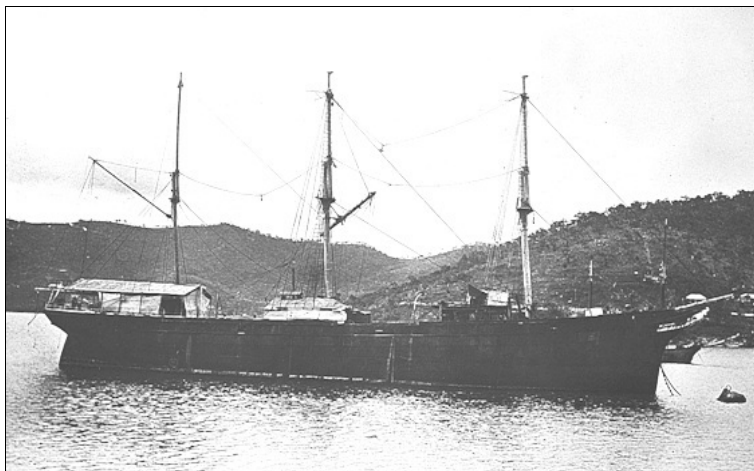
Postcard portrait of “James Craig”

Image: Boat Register.net.

## Later history of “James Craig”

*Clan Macleod* was the first of what became Thomas Dunlop & Sons – later Queen – shipping line, and was the first of his iron ships constructed. She was designed for worldwide tramping – contracting to take on board cargoes of any nature and to transport them to any nominated port.

*Clan Macleod* carried cargo around the world until 1911. It is recorded that she rounded Cape Horn 23 times in 26 years. Her third owner, Mr J. J. Craig, purchased her in 1900 and renamed her *James Craig* in 1905 (after his son).



“James Craig” in Port Moresby, probably around 1915. She has lost much of her rigging and appears to have 3 huts built on her deck.

Image: from Sydney Heritage Fleet (SHF) – source unknown.

In 1918 she was sold to Henry Jones and Company and re-rigged to her original configuration for service as a trading ship for Henry Jones IXL, Hobart. Thereafter followed a slow decline when she was condemned in 1921 and re-classified as a ‘coal lighter’ in 1925. She was based in Recherche Bay, on the far South coast of Tasmania and intended to act as a bunker for coal from a nearby mine. But this didn't happen and she was abandoned, vandalised and left derelict until 1972.

She sailed between New Zealand and Australia until 1911 but at this time sailing vessels were unable to compete profitably for cargo and the vessel was reclassified as a ‘cargo hulk’ until 1918. During this time she was de-rigged and stripped of her jib boom, topgallant masts and all but her main yards, and served as a storage hulk for copra in New Guinea.



“James Craig” at a timber wharf in Adelaide in 1921.

Image: SHF.

## Recovery and Restoration

At this time a minor miracle occurred. What is now the Sydney Maritime Museum/Sydney Heritage Fleet hoped to acquire a ‘tall ship’ to expand its fleet. The *James Craig* seemed to be one of the few alternatives available. On a first visit to the vessel in January 1972 they saw that ‘the hull, half flooded but upright, appeared to be largely intact, although the timber deck had been burnt and there was some structural damage to the stern, forward of the sternpost’.



“James Craig” in Recherche Bay in 1972

Image: Sydney Heritage Fleet.





Geoff (Winter?) cleaning sludge from inside "James Craig". Date not given. What light he has to work in comes from holes in the deck. Image: SHF.

## “James Craig” – Recovery & Restoration

After another more detailed visit it was considered that restoration would be ‘very difficult but not impossible’ and it was decided that the ship should be salvaged. The vessel was re-floated with some difficulty in October 1972 and towed to Hobart. She remained there for another ten years with little restoration work done. It was then decided to tow her to Sydney where a proper restoration program could be undertaken. She arrived in January 1981 and was later placed in a purpose-built dock.

The amount of work required to restore her and make her seaworthy was staggering. Many of the strakes above the waterline needed to be replaced, let alone other structural members, new masts, spars and rigging. Even more importantly, crucial decisions had to be made on whether she should be restored authentically to 1874 condition and used as

a floating museum – similar to the *Polly Woodside* in Melbourne – or brought to survey condition so that she could go to sea and be operated as a working ship. Both options required major compromises – this is a dilemma faced during all similar restorations. Historic vessel management has the following major components – they are similar to the issues in owning and managing other heritage properties.

1. Project planning – the need for a good written plan.
2. Acquisition – a firm commitment to responsible stewardship.
3. Protection – safeguard the vessel from damage or loss.
4. Documentation – record all existing information on history, construction, condition and significance, and all work undertaken.
5. Stabilisation – prevent further deterioration.
6. Preservation, restoration and rehabilitation – involves the choice between carefully preserving what is there; restoring to a particular date which may damage the fabric from other periods; and bringing the vessel to working condition.
7. Preservation maintenance – keeping it in good condition.
8. Interpretation – tell the public what it is all about.
9. Preserving integrity – maintain the heritage values but keep the water out!



1985 – “James Craig” goes on to the purpose built Sea Heritage pontoon dock at Cockatoo Island in Sydney Harbour. Image: Mori Flapan.

I will focus on restoration and rehabilitation. In this case, restoration to 1874 condition would be a purist approach, which might best display the materials and workmanship of the time. As much original fabric as possible would be retained but it would be a static, museum exhibit. In contrast, bringing the ship to survey standard so it could carry passengers and go to sea would require extensive modifications including fire fighting equipment; aluminium hatches; navigation lights; radio and radar; life rafts; and a substantial diesel engine, prop shaft and propeller. However it would provide a multitude of other benefits as a working ship.



The stern of “JamesCraig” with plates along the waterline removed. She is on her pontoon in the Sea Heritage Dock in Sydney. No date, but likely the early 1990s. Image: SHF.

The decision was made to restore its condition, as far as possible, to the last decade of the 19th century, as there were good photographs available to provide technical details. However, the restorers also determined to bring it to survey condition. Then the hard work began.



## “James Craig” – Recovery & Restoration

A workforce with the necessary traditional skills had to be recruited or trained to do the restoration work and a major fundraising program mounted. There were also complex technical decisions to be made including replacing corroded iron hull plates and structural members with mild steel, as wrought iron plates, angles etc. are now very difficult to obtain.

Notwithstanding these obstacles, *James Craig* was accepted into commercial survey in June 2001 and the long process of restoration came to completion.



“James Craig” in full sail – after 2000.

Image: SHF.

### The “James Craig” Today

In October 2015 the restored SV *James Craig* was nominated as an Engineering Heritage National Marker by the Sydney Engineering Heritage Committee as of outstanding engineering significance to the nation. The vessel had earlier been awarded the prestigious World Ships Trust International Medal for authentic restoration. The nomination noted, amongst other things, that she is one of only four similar 19th century iron sailing ships in the world still sailing, and has considerable historic, technical and social significance.



“James Craig” at Princes Wharf, Hobart in Feb. 2013. Image: Brian Martin.

Today, the *James Craig* is owned by the Sydney Heritage Fleet, also known as the Sydney Maritime Museum. She regularly goes to sea with up to 80 passengers and is open for inspection at Pyrmont, Sydney. She also pays regular visits to the Australian Wooden Boat Festival in Hobart, the next of which is scheduled for February 2017.

#### Acknowledgements:

This article drew extensively from the major references below and from a number of other sources.

Boleyn, D. 2015, *Nomination Document for Engineering Heritage Recognition by Engineers Australia Engineering Heritage Committee of Barque SV James Craig*, Sydney Division EH Committee.



“James Craig” in Hobart in February 2011.

Image: Brian Martin.



Sydney Heritage Fleet 2016, *James Craig: 1874 Tall Ship*, viewed 12 August 2016,

[www.shf.org.au/our-operational-vessels/james-craig-1874-tall-ship/](http://www.shf.org.au/our-operational-vessels/james-craig-1874-tall-ship/)

The Secretary of the Interior 1990, *Standards for Historic Vessel Preservation Projects: with guidelines for applying the standards*, U.S. Department of the Interior, National Park Service, National Maritime Initiative.

Wikipedia 2016, *James Craig (barque)*, viewed 12 August 2016, [https://en.wikipedia.org/wiki/James\\_Craig\\_\(barque\)](https://en.wikipedia.org/wiki/James_Craig_(barque))

**The Author:** Dr Brian Martin, Director, Shearwater Associates Pty Ltd has written conservation management plans for several heritage vessels including *PS Gem* (Swan Hill, Vic.), *Lady Harriet's Barge* (Lakes Entrance, Vic.) and the *Queenscliffe Lifeboat* (Queenscliffe Maritime Museum, Vic.).

Left: The “Clan Macleod” ship's bell, cast in 1874 and photographed on “James Craig” by Helen Martin in 2009.



# Notes & Queries – Cultural Significance Reflected in Poetry

## From a past Chair of EHA – a reprise of Bridges and Poetry.

Readers may recall that in the September 2014 edition of this magazine, I wrote about my presentation and discussion about bridges with a group of Canberra poets who meet at the School of Music. That exchange of ideas came to fruition in June when I was invited to launch the booklet of 20 poems entitled *In Response to Bridges*.<sup>1</sup>

The poems contained some physical references to local landmarks like Commonwealth Avenue Bridge and Tharwa Bridge, as well as recollections of past bridge crossings, locally and overseas. There was even reference to one that might have been, in Canberra's ill-fated Immigration Bridge proposal. At a philosophical level there were references to the bridges needed across the generational and political divides, analogies for reconciliation and regrets about destruction through natural disasters and modern progress. As part of the launch address I included comments that I had received about the original article, including one from a teacher in Sydney who wrote:

*I was interested to read of your discussions with a poetry group in the Engineering Heritage Australia Magazine. As a former structural engineer now teaching Engineering Studies & industrial arts, I regularly read poetry and other literature to my classes.*

*The historical and societal component of the course I teach is often dismissed by students who want to get into the technical details. But this aspect provides the 'why' for what engineers do. I am currently researching the use of creative literature in science and engineering education, and I wondered since reading the article what poetic outcomes came of your presentation. I would be interested to read any poetry that it inspired - engineering related or otherwise.*

I wrote back to her after the launch indicating I had used an extract from her message, and wished her well in her work with students in combining an interest in engineering and the arts. I went on to say that I had been encouraged by Prof Moorhouse at Melbourne University in the 1960s, where all his engineering undergraduates had to take a class in visual art appreciation and read some challenging books.



I was delighted to receive a response which included:

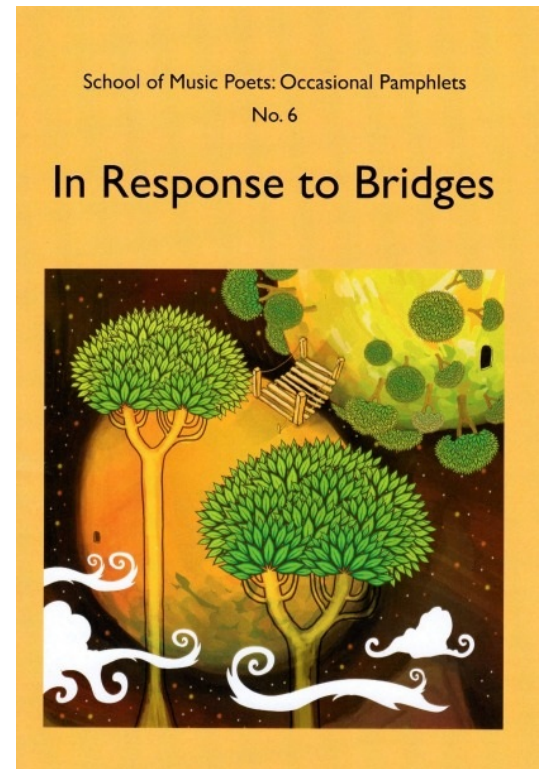
*I will contact the group and look forward to reading the poems. Your comments about Prof Moorhouse have encouraged me to extend my senior students. We are not only reading but are starting to write poetry in response to our engineering studies. I firmly believe that you should not ask students to do what you wouldn't do yourself, so have put pen to paper in preparation for our case study of the Sydney Harbour Bridge next term.*

The students subsequently were able to reflect on not only engineering aspects of the hot riveted steel structure of the bridge, but its design by J.J.C. Bradfield, the social and industrial issues with its construction and the drama that accompanied the opening ceremony. Such aspects clearly form part of the cultural significance of the Harbour Bridge and their study can encourage an early interest in engineering heritage.

I'm pleased that my encounter with the School of Music Poets has led to more creative writing about bridges and exposed a lighter side of engineering heritage. It has also brought to light a case of much needed teaching of engineering history.

*Keith Baker FIEAust CPEng  
Past Chair EHA*

Left: Bridge to the National Carillon, Aspen Island,  
Lake Burley Griffin, Canberra. Image: Keith Baker.



<sup>1</sup> Information about the group can be viewed at <https://sompots.wordpress.com/> and copies of the poems can be obtained by emailing [sompots.canberra@gmail.com](mailto:sompots.canberra@gmail.com)



# Notes & Queries – The Tractor That Changed the World

## Happy 70<sup>th</sup> Birthday to the Little Grey Fergie – or is it? From The Editor

The *North East* [Victoria] *Farmer* drew my attention to the 70<sup>th</sup> anniversary of the first Ferguson TE20 tractor, rolled out on July 6<sup>th</sup> 1946 from the Ferguson factory in Coventry, UK. This tractor and its successors made a huge impression on world agriculture and revolutionised the way we used tractors and handled farm implements forever after. It was designed by British engineer and inventor Harry Ferguson, founder of the present day Massey Ferguson company. *Key to the global success of the tractor was its unique three-point linkage implement attachment system controlled by the tractor's hydraulics. Designated the 'Ferguson System,' this effectively turned the tractor and implement into a single working unit, replacing the previous cumbersome trailed method of implement operation.*<sup>1</sup> You could attach ploughs, rippers, carry-alls, lifting jibs, scoops, graders, and more – and tractor and implement worked as one. The Fergie, with a 20hp petrol or petrol/paraffin (kerosene) engine, was small and light and easily manoeuvred and cheap to run – perfect for English farms and for not so small Australian farms.



Harry Ferguson testing the TE20. Image: Massey Ferguson website.

Only two months after that world changing day, my Dad and I were having a camping/skiing holiday, in an old hut near the top of Mt Feathertop in the Victorian Alps. We had only a couple of hurricane lamps for lighting after dark, but Dad was well prepared with books for both of us in our rucksacks. I can't remember what I had, but Dad kept reading me bits from his new book, published in 1942, and bought 'specially for the holiday. I never forgot it, and neither did Dad, and when I grew up, I bought my own copy, 2<sup>nd</sup> hand, for 36 cents. You may ask – What has this to do with Ferguson tractors? Well, you will see! The book is *The Story of a Norfolk Farm*<sup>2</sup>, a derelict farm bought by the author (Henry Williamson) in 1936, and it tells of his struggles to rebuild it to a financially viable state, while writing at night to pay the bills, (rather like my Dad later on!).

In 1938 Williamson bought a Ferguson-Brown tractor, designed by Harry Ferguson and built in 1936 (note the date – 80 years ago), and here is part of what Dad read to me from the book in 1946:

*I turned away from the failure of my [cottage restoration] scheme and regarded the new tractor. It was as beautiful as the cottages were sordid. . . . The tractor was a work of genius. It was the result of many years' experimenting by a Belfast engineer named Harry Ferguson. The Ferguson tractor was not a great lumbering old fashioned thing which drew a contraption of heavy iron framing of plough-breasts and shares, an iron monster that would press down the land with its weight and dig itself into the hillside. It was half the weight of an ordinary tractor, built of aluminium and of immensely strong steel, and it carried its twin furrow plough under its tail, on three steel arms that looked like a grasshopper's hind legs. On pulling a lever like the short gear change lever of a racing car, the twin ploughs lifted up out of the ground. Instead of lugging a heavy sledge of ploughs around a field, bibbling, as Bob said, at the corners, this new design of tractor lifted its tail, and, put in reverse, moved back to exactly where one wanted to drop the implements. It had a petrol engine which looked absurdly small; but the engine would be in use two or three seasons after an ordinary paraffin-fired engine was scrapped.*



A 1936 steel-wheeled Ferguson-Brown tractor, with 3-point linkage holding a twin-furrow plough. Image: from a recent Fergie Field Day in the UK.

*Both Bob and Jimmy were sceptical of its performance. 'You won't beat bosses on that ould sod of a Hilly Piece. No tractor can git up thar.' So, as soon as it was run on planks off the lorry, I took it to Hilly Piece. . . . It was twilight when I got to the field. I took the tractor to the bottom of the steepest part. The engine purred almost silently. I pushed down the lever controlling the hydraulic gear, which dropped the twin ploughs. I put it in ploughing gear, let in the clutch, and opened the throttle. . . . The little machine went up without the least falter. Its thin spiky wheels pressed the ground lighter than horse-boofs would have done. Its twin shares bit into the sullen soil and turned it over, exposing a tangle of white roots. I heard Bob mutter: 'Blast, I like that patent,' as he stared at it. This was the highest praise from one who regarded many of my schemes with hard-eyed caution.*

At the time my Dad was a returned serviceman from WW2, with an Agricultural Science degree and newly employed as the Manager of a large farming estate in the Yarra Valley.

But he never stopped hankering after a farm of his own, which he finally achieved, courtesy of the Soldier Settlement Commission, in 1949. And what was one of the first things he bought? You guessed it, the latest Ferguson tractor!

So you see that this year, 2016, is really the 80<sup>th</sup> anniversary of the Ferguson Tractor with the three point hydraulic-lift linkage that became the international standard method for connecting tractors and tractor implements throughout the world.

1 From *Hay & Silage*, in the *North East Farmer*, August 2016, p11.

2 *The Story of a Norfolk Farm*, by Henry Williamson, published in 1942. Williamson was a well known novelist and naturalist whose most famous book was *Tarka the Otter*. He fell out of favour with the public before WW2 because of his political views and sympathy with Oswald Mosley.



# Duke & Orr Dry Dock Pump House Conservation Project.

## Background on the Duke & Orr Dry Dock in Melbourne

By Owen Peake

Commercial dry docks have been located on the south bank of the Yarra River at South Wharf just west of the current Spencer Street Bridge since 1875. The last remaining dry dock was expanded and rebuilt in 1902-1904 by the then owners Duke and Orr. The dock closed in 1975 because the Victorian Government, in its wisdom, built a low level bridge (the Charles Grimes Bridge) across the river downstream of the Duke & Orr facility. Ships could not pass under this bridge so the dock had to be closed.



The Yarra River in 1925, viewed from somewhere above Port Melbourne looking upstream. Duke & Orr Dry Dock is on the mid-right, with a 3-masted ship moored just below the Dock mouth. Image: Herald Sun image library - no attribution.



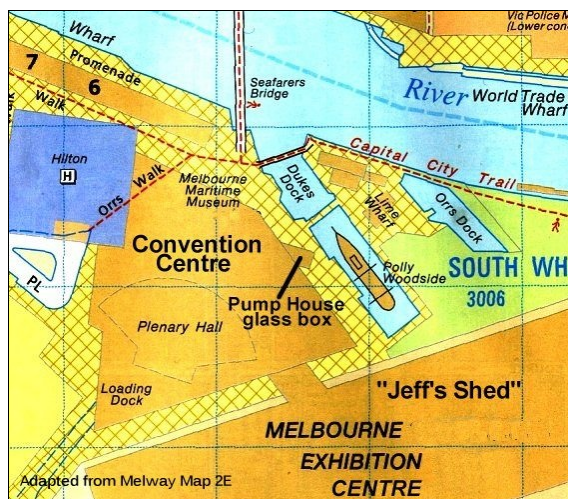
The Yarra River in the 1980s. The River has been closed to ships. The Duke & Orr Dry Dock is at bottom right. The biggest changes up-river since 1925 are the opening of the Spencer St Bridge in 1930 and the King Street Bridge in 1961. Image: Walking Melbourne, Aerials of Melbourne - no attribution.

The company then purchased a floating dock which it placed below the Charles Grimes Bridge however the floating dock was too small for much of the work then required to be carried out in the Port of Melbourne. When the floating dock was sold the Port of Melbourne no longer had facilities to dry-dock larger ships which now have their maintenance and repair carried out in Asian ports.

The original dry dock was shortened considerably when an Exhibition Centre (Jeff's Shed) was built over the southern end of it. The surviving river end of the Dry Dock then became the permanent home of the National Trust-owned barque Polly Woodside. A few years later, an enormous Convention Centre was built in the gap of land between the west end of Jeff's Shed, the Dry Dock, and the river. The Pump House, complete with its pumping machinery, somehow (almost miraculously) survived intact, inside a glass walled box beside the Convention Centre.



Jeff's Shed in 1995, viewed from somewhere above the Melbourne CBD, looking SW. Duke & Orr Dry Dock, with "Polly Woodside" in it, is just above the semi-circular "World Trade Centre" building on the north bank of the Yarra River. Image: Herald Sun Image Library - no attribution.



The pumping machinery is located in a deep brick-lined pit inside a timber-framed building clad with corrugated iron. The boilers were located in an adjacent steel-framed building with corrugated iron cladding. When a glass box, forming part of the Convention Centre, was built over, but clear of, the original pump house buildings, large apertures were cut in the corrugated iron cladding of the timber framed pump building and most of the cladding of the steel-framed building over the boilers was removed. This gives the passing public a workable view inside the pump house, through glass.



## Background on the Duke & Orr Dry Dock

The pumping machinery consists of a large vertical inverted duplex tandem compound steam pumping engine driving two centrifugal pumps, one each end of the crankshaft.

[See box at right]

Its two associated multi-tubular boilers and some auxiliary plant also remain. The pumping engine and boilers were manufactured c1904 by Robison Brothers & Co Pty Ltd, a company then located only metres away from the pump house.



West end of the glass box, with the pump house inside. Image: Google Earth.

Three volunteers – Derek Moore, a member of both the National Trust and the Melbourne Steam Traction Engine Club, Miles Pierce from EHV and myself (also from EHV) had formed a close working relationship with staff of the then Major Projects Victoria unit of the Victorian Government.



The author (right) and Derek Moore clean the concrete ground floor around the pump well prior to repainting it.

Image: Miles Pierce, Sept 2013.

Inverted means that the engine is vertical and the crankshaft is at the bottom.

Compound means that the steam is used twice – in a high pressure cylinder and then in a low pressure cylinder to extract more energy from the steam.

Tandem means that the two high & low pressure cylinders in each bank of the engine are end-to-end and share the same piston rod.

Duplex means that there are two identical banks standing side-by-side with the flywheel between the banks and sharing the same crankshaft.

Some call this configuration “two” engines but I prefer the internationally established definition, supported by the International Stationary Steam Engine Society (ISSES).

Note from Owen Peake

After the Convention Centre was built adjacent to the dock and the pump house was enclosed inside the huge glass box forming part of its structure, the National Trust withdrew from supporting the pump house and the government was left with the problem of maintaining an historic site. This is where Engineering Heritage Victoria (EHV) stepped into the picture.

### *EHV comes to the rescue*



From the inside looking out. Shows the fence around the pump well with gate & ladder. The steam engine cylinder is at bottom right. Through the glass there are glimpses of the tall buildings on the other side of the Yarra. Image: Owen Peake 10 Sept 2013.

In 2011 the committee of EHV decided to offer the services of this small group of volunteers to assist the Victorian Government, which owns the Pump House, to maintain, conserve and develop the site to a point where it could be opened up to visitors on special occasions. It took until the middle of 2013 to get agreement for access and working arrangements, however from 10 September 2013 the volunteer brigade has been working in the pump house regularly.



## Duke & Orr Dry Dock Pump House – Tasks which have been undertaken



The author cleans floor plating on the operating floor prior to painting while kneeling between the two sets of high & low pressure cylinders. Part of a pump can be seen below the floor grid. Image: Miles Pierce, Sept 2013.

The volunteer group typically spends one day per month working at the site plus some workshop and procurement time off-site in between.

The first task was to clean up a vast amount of rubbish and equipment which had accumulated in the pump house. At this stage even gaining access just about required climbing equipment. Every piece of loose material in the pump house was assessed for its possible relationship with the site. Items belonging to the site were stored, mostly on top of the boilers. Rubbish was removed and some artefacts associated with the dock itself are still stored adjacent to the boilers in the very confined site.

When we had restored reasonable working access we spent many monthly visits cleaning and stowing parts and materials in an organised way.

After that we started to systematically work on six medium term priorities:

- Repainting all painted surfaces, most of which were in a poor state.
- Carrying out more systematic cleaning of the machinery.
- Restoration (or augmentation) of systems to keep the site safe, dry and convenient for workers and visitors.
- Minor restoration, primarily re-installing parts into their correct positions.
- Attending to urgent safety issues.
- Interpretation of the site for the passing public.
- Painting and Cleaning



Main pump casing (foreground), the engine behind it, and the 2<sup>nd</sup> pump casing just visible behind that – all before repainting. In the background is Paul Stephens, President of ISSSES, on a visit to Australia. Image: Owen Peake.



Engine crankshaft with main engine bearing (left), valve eccentric strap, turning gear and pump casing (right). Still much cleaning and polishing to be done. Image: Owen Peake.

There are very large painted areas on the equipment. Considerable cleaning and repainting has been carried out but this task will go on for years. The open steel access platform around the engine, the centrifugal pump casings, outlet pipework (about 1.2 m diameter) and the concrete floors have been completed.

Work has now started

on the lower structure of the steam engine including the bed frame and the four cast iron main columns which support the cylinders. Much pipework and smaller items of equipment remain to be painted.

Right: Inside the bottom end of the engine. Main crosshead and piston rod in the background, valve rod to middle left and an exhaust pipe support strut at extreme left. Image: Owen Peake.





## Duke & Orr Dry Dock Pump House – Tasks which have been undertaken

Some cleaning of the bright work of the engine from the crankshaft up to the bottom of the cylinders has been undertaken but the pump pit has been flooded several times which means much more elbow grease is required in this department. Large items such as connecting rods, crankshaft and valve gear should eventually be brought back to “bright” condition.

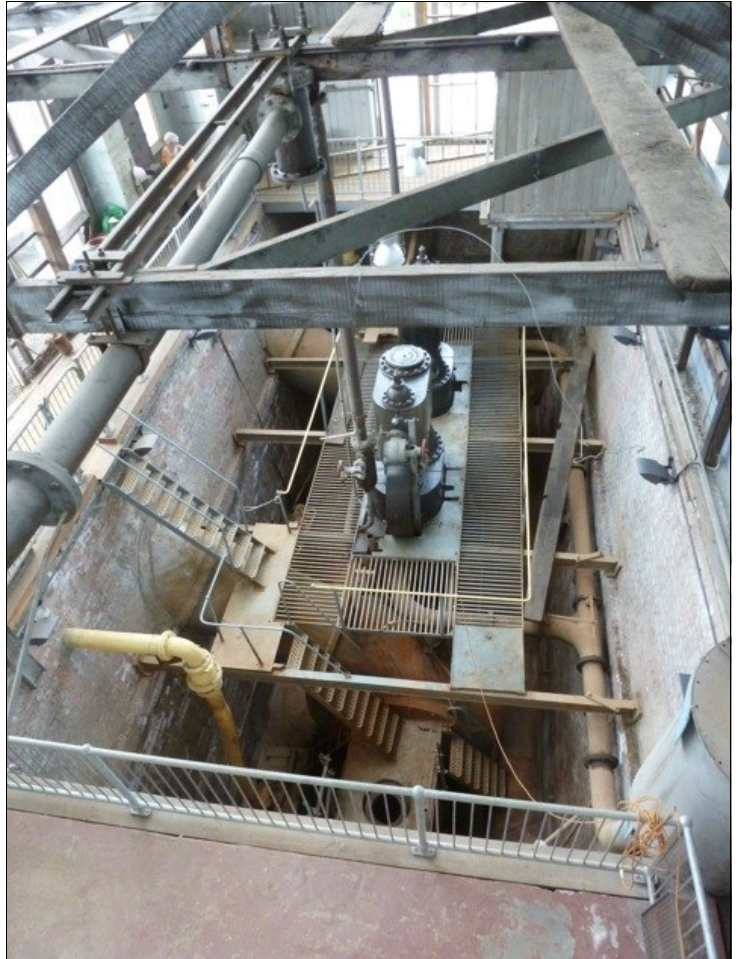
### Restoration of Systems

The greatest challenge of the project to date has been to keep the pump pit dry. The pit is about 6 metres deep and the bottom of it is about 5 metres below river high tide level.

Water leaks into the pump pit via the main pump outlet pipes during high water events in the adjacent Yarra River. Blanking-off the auxiliary pipe flanges and using sealing compound to waterproof the 110 year old seals of the two large non-return valves has been a major task carried out partly by contractors to the Victorian Government and partly by the volunteer group.

Water from the adjacent dry dock, (now usually filled with water because the Polly Woodside is a floating exhibit), has to be held back from the pump pit. This has been achieved by placing concrete ‘plugs’ in the two large suction connections to the main pumps and several auxiliary pipes.

This sealing is critical as very large quantities of water can enter from these sources and overwhelm the two modern sump pumps installed in the bottom of the pump pit. Whilst some work is still required to improve the security of the ‘dry pump sump’ the most serious problems have now been addressed.



Looking down into the pump well (empty of water in Sept 2013) from the top of the boilers at the west end of the pump house. Original roof cladding has been removed, leaving the timber roof structure intact. Image: Miles Pierce.

When it was originally built there was no ventilation of the glass box which encloses the pump house. With all that glass and no ventilation the internal spaces became very hot, and very uncomfortable for working during Summer.

A ventilation system has now been installed to remove hot air from a high level in the glass box and draw outside air in at a lower level through newly installed ventilation grilles. An exhaust fan has also been installed low in the pump well to remove any accumulated heavier-than-air contamination. This work has been carried out without significant impact on the heritage materials.



Flooding of the pump well nearly up to the operating floor in 2010, before work started on the pump house and before flooding was stopped. Image: Owen Peake.

All the electrics in the building are new from the time of construction of the glass box building. Older electrical switchboards and equipment have been left in place but are decommissioned and disconnected from supply.

Work remains to be carried out to provide a water supply to the pump house. Our water supply at the moment consists of brackish water lifted on a rope by bucket from the river. This is a bit crude but at least it is maintaining heritage traditions!



The author & Derek Moore pumping flood water from a pump casing. Image: Miles Pierce, Sept. 2013.



## Duke & Orr Dry Dock Pump House – Restoration of Systems



High pressure cylinders of the Duke & Orr pumping engine, with the top of the low pressure cylinders below them, and just projecting above the operating platform. Photographed through the glass wall, hence the shadowy reflections of metal grilles. Image: Owen Peake.

Below: Detail of the top of the right hand low pressure cylinder in the photo at left. These two photos show how well preserved are those parts of the engine which were not constantly submerged. Image: Owen Peake.



### Restoration of the Heritage Equipment

Much of the restoration to date has been related to restoring items removed from the machinery back to their correct position. For example the engines were originally fitted with a simple mechanical emergency stop mechanism which could disconnect steam supply from the engine without the operators having to descend from ground level to the operating platform of the engines several metres down into the pump well. This mechanism involved ropes and pulleys which were set up so that by pulling on the ropes, the main supply to the steam engines could be shut off very quickly using a butterfly valve. Most of the parts of this mechanism have been found and we are in the process of reinstalling them in their original position.

There are many other examples like this.

At a more fundamental level the Victorian Government would like the pumping engine to be able to run, probably on compressed air, to demonstrate its operation to visitors. This will require de-coupling the pump impellers, freeing up all moving parts of the engine and restoring all functions necessary for limited operation. Work has barely started on this task but it is entirely achievable in the medium term.

Restoration of various auxiliary systems such as auxiliary electric pumps, air ejectors (to remove air from the pump casings when the pumps are being operated without flooded suction), steam lubricators and all instrumentation in the system should be achieved in the long term.

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#### Some Images of the Boilers

Right: The top of the boilers. Safety Valves and Main Stop Valves can be seen with the stump of the steel chimney at the rear. Underfoot are the exposed curved, rivetted steel boilers with brickwork between them. Spare parts and equipment are now stored here. Image: Miles Pierce

Below: The boiler firing aisle. Boilers were fired from a pile of coal at right (where the glass box wall is now). Image: Owen Peake



Right: Test Plate on a Robison Bros Boiler. The operating steam pressure of the engines was 190 psi (1310 kPa), so the test pressure was 31% above the operating pressure.

Image: Miles Pierce.





# Duke & Orr Dry Dock Pump House

## Interpretation

With financial support from the Victorian Government and the services of a consultant specialising in interpretation, four interpretation panels have been designed, manufactured and installed around the pump house. One of these panels is the Engineering Heritage Australia interpretation panel. The panels were 'unveiled' at the heritage recognition ceremony in November 2014.

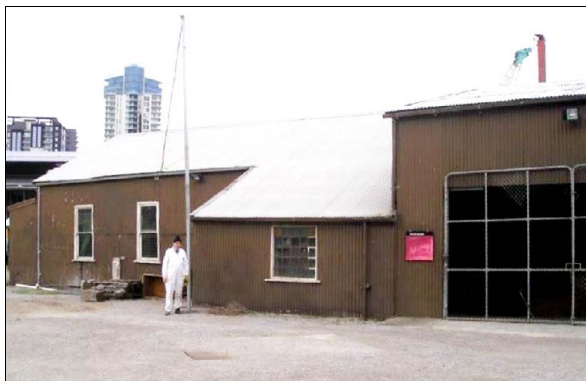
Our observations while working in the pump house suggest that hundreds of people read the panels on almost any day and in most weathers.



Part of the crowd at the heritage recognition ceremony, with several well-known EHA identities in attendance. Owen Peake, Nov. 2014.



Two of the interpretation panels set up behind the glass on either side of a glass box wall post. Image: Owen Peake, Nov. 2014.



The building in 2006, viewed from the north. The pump house is at left and the boiler house at right. Image: Miles Pierce.

Several trial tours have been successful and there is probably an ongoing, but limited, market for such tours.

In the meantime three blokes who like being around steam engines continue the work at a leisurely pace (in among many other calls on our respective schedules) with a long term plan to bring the pump house back to life.

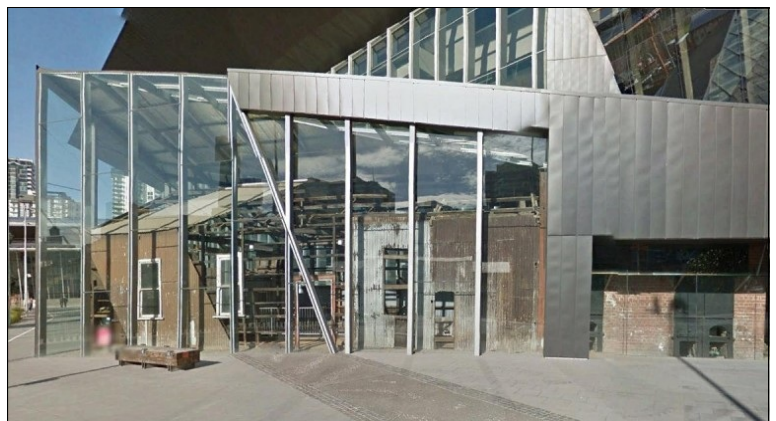
More information can be found at :

<https://www.engineersaustralia.org.au/portal/heritage/duke-orr-dry-dock-pump-house-melbourne-1904>

## Summary and Benefits

Whilst the maintenance and restoration tasks seem almost endless three years into the project, great progress has been made and the site is now presentable to visitors with interpretation being improved over time. Ultimately it would be very gratifying if the engine could be run on compressed air in an environment where the pump house is approaching its original condition and is clean and tidy as it would have been when it was in commercial service.

The conservation team would also like to see regular public guided tours of the pump house.



The Pump House and Boiler House again, viewed from the north and enclosed within their glass box. Image: Google Earth



# Notes & Queries – the Bairnsdale to Orbost Railway.

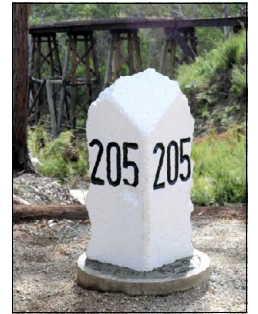
## *There's no such thing as coincidence – or is there?*



The Stony Creek railway viaduct near Nowa Nowa, Victoria. Image: Owen Peake

Engineering Heritage Victoria (EHV) held a heritage recognition ceremony for the Bairnsdale to Orbost Railway at the Stony Creek railway viaduct near Nowa Nowa, north of Lakes Entrance on 21 August 2016. Our major partner in this heritage recognition project was the Department of Environment, Land, Water and Planning (DELWP) whose local representative at Nowa Nowa, Gus Gustus, proposed to incorporate the 205 mile post from the railway into the heritage recognition interpretation.

The mile post [at right] was probably accidentally knocked over during the process of recovering the rails and sleepers from the railway many years ago. It was found recently, much battered, during clearing operations around the bridge site to reduce fire hazard. Gus



repaired the concrete mile post and placed it near the EHV interpretation panel at the viewing platform at the eastern end of the viaduct.

Victorian Railways mile posts measure the distance from the No.1 platform at Melbourne's Spencer Street Railway Station (now called Southern Cross Station) to all points in country Victoria. The correct location of the mile post was thought to be near the eastern abutment of Stony Creek viaduct, very nearly the same distance from Spencer Street as where it has been re-erected, although somewhat further from the rail centre line than it would have been originally.



Gus Gustus and Gail Penfold of DEWLP at left, with Guy Hodgkinson of EA and Helen Martin, former Director of East Gippsland Shire, all helping unveil the EHA interpretation panel. Image: Owen Peake.

Part way through the short ceremony Guy Hodgkinson, Deputy President of Engineers Australia Victoria Division, representing Engineers Australia at the ceremony, stated that the ceremony recognised the 205<sup>th</sup> site in the national Heritage Recognition Program. There was a short pause in proceedings as we all realised that the mile post and the ceremony sequence number were the same number.



Looking from the viewing platform towards the Stony Creek viaduct.

Image: Owen Peake

While we are constantly told by police officers that “there is no such thing as coincidence”, I think here we have a real case of pure coincidence – the 205 mile post at the site of the 205<sup>th</sup> heritage recognition ceremony!

*from Owen Peake*



# Trams in Australia

*A survey of many types of tram once (and some now) found around the country.*

*From Miles Pierce*



Adelaide & Suburban Tramway Co. double-deck horse tram passing the (then) City Baths, c1903. Image: The Tramway Museum, St Kilda, South Australia.

Trams, running on rails typically laid along urban streets have been a feature of public transport in the capital cities of all Australian States and some regional towns and cities for more than 150 years. Horse drawn trams were first introduced in Sydney's CBD in 1861, in Gawler, South Australia, in 1879, Brisbane in 1882 and Melbourne in 1884.

Relatively long lived in some places, steam powered trams gained favour and after first appearing in parts of Sydney in 1879 they were established in Newcastle, Bendigo, Broken Hill and Rockhampton, among other places, in the succeeding three decades.

Typically, steam trams used a small, specially built locomotive to haul one or more passenger vehicles or 'cars'. Rockhampton however employed the French Purrey tram, where the steam engine was integrated into a passenger vehicle. Steam trams were generally quicker than their horse drawn counterparts but had noise and air pollution drawbacks, despite efforts to mitigate this by careful boiler design and burning low smoke fuels such as coke. However, Sydney had a 'love – hate' relationship with steam trams on city and suburban streets which continued in some suburbs up until 1937, long after the introduction of electric trams. A separate system in Parramatta finished in 1943. The Rockhampton Purrey steam trams operated in that city from 1909 to 1939.



A restored Purrey Steam tram in Rockhampton, Qld. The driver is at left and a stoker at right, attending the boiler and steam engine at the rear of the tram. This restored tram is thought to be the only one surviving anywhere. Image by Mal Rowe in the Trams DownUnder website archive.



*[A steam tram from Newcastle to West Wallsend, with a branch line to Speers Point on Lake Macquarie, persevered until 1930, long after electric trams were introduced in most places. This was because the West Wallsend route was 25 km long – longer than any other known tram route at the time, and partly through open country and bushland. Building the extra infrastructure for electric traction was considered uneconomic. Ed.]*

Left: A Newcastle to West Wallsend steam tram at its terminus, circa 1914.

Image: Courtesy of the Dr John Turner Collection, University of Newcastle (Australia).

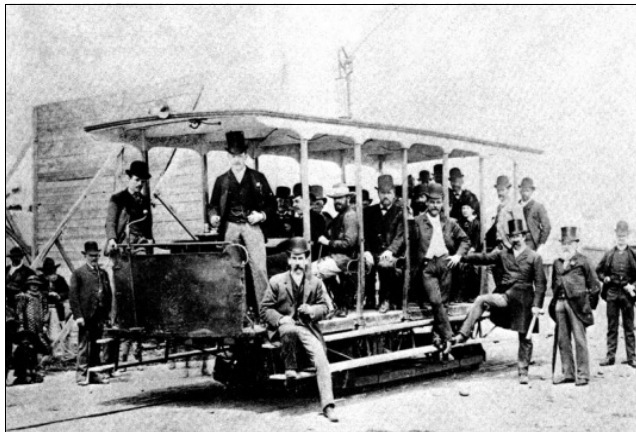


## Trams in Australia

Melbourne was the third city in the world, after San Francisco and Dunedin (NZ), to install a cable tram network, beginning in 1885. Over the following decades, the cable tram network serving the Melbourne CBD and inner suburbs grew to one of the largest such systems in the world with some 75 km of double track routes with the under-street cables between the tracks powered by large steam engines in twelve handsome engine houses. Although the technology originated overseas, much local engineering ingenuity went into implementing and operating the Melbourne cable tram network. It finally succumbed to the dominance of electric traction with the last cable tram service withdrawn in 1940.



A cable tram on Spring St, Melbourne, in front of Parliament House. The motive car with cable grips is at right, closed trailer car at left. Image: "Walking Melbourne".



Melbourne's first electric tram, running in 1889 between Doncaster & Box Hill along Tram Road. Image: "Walking Melbourne" website.

The first electric tram for the conveyance of public passengers in the southern hemisphere ran on a 3.6 km track between Box Hill and Doncaster in suburban Melbourne from 1889 to 1896. The tram was originally imported for the 1888 International Exhibition in Melbourne where it ran on a demonstration track.

The first successful multi-suburb electric tramway network opened in Hobart in 1893. It was the only Australian electric tram service to use double decker cars and also to utilise bow collectors for contact with the overhead wire.



Two Hobart double-deck trams. Note the bow collectors on the roof. Image: State Library of Victoria, via Wikipedia.



Above: Tram No.35 in Melbourne St, South Brisbane in 1964. Image: LindsayBridge, used with permission.



Left: Trams on George Street Sydney in front of the Queen Victoria Building in 1920. All these trams (and the ones above) have trailing trolley pole collectors. Image: From NSW State Records.

Brisbane followed Hobart with an electric tram service opening there in 1897. Sydney inaugurated an electric tram service in 1898 that progressively replaced the earlier steam trams and at its peak covered 264 km, making it one of the largest electric tram networks in the world in the late 1940s to the early 1950s.

Right: Early model electric trams on George St near Hunter St in Sydney, c1900. Men with brooms are sweeping up horse manure. Image: From the Powerhouse Museum.





## Trams in Australia

All of the State capital cities and eight regional towns or cities hosted electric tram based public transport systems, with the last one being Newcastle commencing in 1923.

Electric trams in Australia typically use the 'standard' rail gauge of 4' 8½" (1435mm) with current collection from an overhead wire via trolley poles, or now more generally a pantograph, mounted on top of the tramcar. Most systems operated at 600 Volts DC, latterly supplied from AC-DC converter substations using solid-state semiconductor rectifiers but previously, via motor-generator sets, rotary converters and/or mercury-arc rectifiers. In some cases, specific electricity generating stations were built such as the 1899 Ultimo power station (now 'Powerhouse Museum') in Sydney and the 1906 North Melbourne Electric Tramway and Lighting Company's Flemington power station.



Rotary converters, installed in a Melbourne Tram Substation in c1929. Decommissioned in the 1990s, but still in situ. Photo: Miles Pierce.

In the early days of public electricity supply, trams could supply revenue producing daytime load before the widespread use of electric motor drives for industrial purposes, when electricity demand was otherwise mainly at night for electric lighting. The Geelong, Ballarat and Bendigo electric tram systems in Victoria were initiated on this basis.

In keeping with trends elsewhere in the UK and North America, the 1950s and 1960s saw electric trams dropping out of popularity for street based public transport in favour of motor buses and private cars. Exponents of tram abolition cited greater route flexibility and the avoidance of obstruction to motor traffic, particularly where trams ran down the middle of narrow roadways. Sydney lost its former extensive tram network by 1961 whilst Ballarat and Bendigo in Victoria finally succumbed by 1972, although Bendigo retained tourist trams, which still operate. Adelaide retained only its city to Glenelg tram service after 1958.



A vintage "Talking Tram" remained in service after Bendigo Tramways closed in 1972. Photo: Peter Sage, 1977.



Coupled "O" class toastrack Sydney trams on the bridge over the Bradfield Highway, heading for the Harbour Bridge. Note a conductor stands on the foot board as the tram travels along. Photo taken from the Greenway Flats, Kirribilli circa 1950s. – from Vic Solomons Collection via Lindsaybridge..



## Trams in Australia

Whilst similar public pressures prevailed in Melbourne to replace its electric trams with buses, the determination and influence of the then chairman of the Melbourne & Metropolitan Tramways Board (MMTB), Robert Risson, coupled with Melbourne's often wide city streets, resulted in the tram network being retained and in more recent years expanded in extent and progressively equipped with modern rolling stock. The present electric tram system in Melbourne, covering 250 km, has the distinction of now being the largest operating electric tram system in the world.

[ Right: This Melbourne W class tram No.269 possibly entered service around 1926, and was still going strong in the 1970s. Us Melbourne oldies will remember this style of workhorse – with its two closed sections and breezy mid-section. – Ed.]

Photo: from website Melbourne W2 Trams.



Left:  
This wonderful photo of Flinders St Station at the intersection of Flinders & Swanston Streets in Melbourne was taken in 1927.

A new W-class tram (at right) heads south to St Kilda Road; an older T(?) class electric tram (at left in front of the station) heads north into the city; and (bottom left) a cable tram and trailer heads west along Flinders Street.

Note also the convertible roadsters, the limousine, and even a brewer's dray and, near it, a man with a spade for collecting horse manure!

Photo: Victorian State Transport Authority.



A new Sydney Light Rail car, photographed on 27 August 1997. Image: Lindsaybridge, with permission.

Electric trams in Australia and elsewhere have had a renaissance in the last twenty or so years. Starting in 1997, Sydney now has a new tram, or so called 'light rail' service operating between Central and Dulwich Hill with another route expected to come on stream in 2019. In 2014, a 13 km single track electric tram, dubbed 'G:link', was inaugurated to serve Queensland's Gold Coast. Plans to reintroduce electric trams in Perth and in Hobart have also been promulgated, along with the letting of construction contracts in the National Capital where ironically Canberra's designer, Walter Burley Griffin in 1912, envisioned an extensive tram network to serve the city.

by Miles Pierce.

*References:* Brimson S, 1983, *The Tramways of Australia*, Dreamweaver Books, Sydney.

Fiddian M, 2002, *Australasia's Tramways*, Galaxy Print & Design.

Keating J D, 1970, *Mind the Curve! – A History of the Cable Trams*, MUP and [www.en.Wikipedia.org/wiki/Tram](http://www.en.Wikipedia.org/wiki/Tram)



# Vale Dr John W. Connell, A.M., D.Eng. – 1913 to 2016

John William Dennis Connell was born in Brunswick on 22nd October 1913 and grew up in Melbourne. Already, at age seven, he had decided he was going to be an engineer, an ambition that probably grew out of many weekend visits to construction sites with an uncle. He told his daughter, Patricia, that *he used to annoy workmen working on building sites to see if he could do things to help them*. I expect he also took every opportunity to peer through the holes in fences around building sites to watch what was going on inside.

He left school at a young age – probably soon after he turned 14, the legal age one could leave school in 1927 – and went to work, at first working on a bread cart, and saving every penny to pay the fees at night school. He is said to have gained his early technical education at Preston Tech (NMIT), but as this school wasn't opened until 1936, and he already knew he was going to be an engineer, it is more likely he attended the Working Men's College (RMIT) in the City, a place with a proud history of educating engineers since 1903. Throughout the Depression he found work wherever he could, augmenting his bread-carting income selling Singer sewing machines door-to-door, among other jobs.

By the time he turned 25 he felt well enough established to contemplate taking on the responsibility of a family, and he married Merlyn (Merle) Gladys Sharpe in 1938. They had three children – Helen, Barbara and John Jnr. Merlyn and John remained together for 66 years, until Merlyn's death in 2004, by which time they had nine grandchildren and two great-grandchildren. In 1939, the year following his marriage, his perseverance with his technical studies paid off, and he began his distinguished engineering career as a junior draftsman with the small but prestigious engineering firm of Cyril Hudspeth and Associates in Melbourne. It is speculation, but I think he would have been very soon engaged in design and supervision as well as simple drafting work. In 1940, Hudspeth was engaged by the firm of Romberg & Shaw, architects, for the engineering design of at least one of their landmark blocks of flats in Melbourne suburbs. Considering that Romberg and Connell probably first met in 1940, it's not beyond the bounds of possibility that they developed a mutual respect that lasted many years, and led to the involvement of Connell with Romberg's partner Roy Grounds, in the design of the Arts Centre buildings in St Kilda Road.

In August 1942 he joined the AIF – not the engineers, nor the artillery as one would imagine, but the 57th/60th Infantry Battalion. This unit of the Militia was commonly known as the Merri/Heidelberg Regiment, having been formed from two adjoining Melbourne Militia units in 1930. Its headquarters were in Preston, where Connell lived, and he probably joined up as a part-time soldier some years before the War. By early 1941, his provisional militia rank of Lieutenant was confirmed and in November 1941, he was promoted again to the (temporary) rank of Captain. His battalion “left home” for camp in Seymour in early 1942, then Albury, and then in May 1942 to Casino in Northern NSW. Meanwhile, Connell remained in Melbourne, still working for Hudspeth, who is understood to have had a number of Defence contracts, and wouldn't have let him go easily. Captain J.W.D. Connell (VX81067) was eventually posted to the 57th/60th while they were still encamped at Casino, in northern NSW, and presumably, by then, training for the rugged jungle warfare to come.



Capt. J.W.D. Connell, VX81067 in 1942.  
Courtesy of the Connell family.



Major J.W.D. Connell (right) with his CO Lt.Col. R.R. Marston at Dumpu, New Guinea in 1944. Image: Aust War Memorial No.070285.

Early in 1943 the Battalion was sent to the Goon Valley, behind Port Moresby in New Guinea. In his forward to the 2011 issue of the Battalion magazine, Major John Connell refers to at least one occasion when he found an engineering job that could be done by him without calling in the Sappers. “the big hole (he) dug” was very clear in his memory.

*Our C.O. was very concerned with our lack of water in Goon Valley. He detailed me to join him in his anxious hunt for water. I learned that he believed in “divining”, but I was at least sceptical. However, after a long search he gained a strong reaction in our area, and after several tests, he instructed me to have a hole dug, to find the water, then for me to supervise the erection of a shower system. To shorten the story, he proved successful, so the unit could have daily showers.*

After service in areas around Moresby, the 57th/60th, in the 15th Brigade, joined the 7th Division in the Ramu Valley and Shaggy Ridge areas in early 1944 for some pretty torrid battles and significant victories including the capture of Madang by a patrol from the Battalion on the 24th of April.



## Vale Dr John W. Connell, A.M., D.Eng.

The 57th/ 60th returned to Australia in August 1944, to regroup in North Queensland in October. But (by then) Major Connell was no longer with them. He was discharged from the army in October 1944. May I presume he was requisitioned to go back to work with Cyril Hudspeth, who was still busy with Defence contracts.

John Connell resumed his structural engineering studies at the Working Men's College, and by correspondence with the Institution of Structural Engineers in London. He was still working with Hudspeth in 1956, and was thinking of setting up his own practice when Cyril Hudspeth died suddenly. Connell is said to have gone out on a limb financially to acquire the practice from the Hudspeth estate, and in 1958 he changed the name of the practice to John Connell and Associates. The practice then was small – about 15 employees – but it grew and developed as John Connell planned it would. This was part of a conscious plan for the development of Connell himself and his firm and his people. *In the early days of the firm, John and Merle created a family atmosphere including recognizing the arrival of staff members' babies and with family outings and Christmas presents, always a book, for each one.*<sup>1</sup> Inevitably, as the years passed and the firm grew larger and more dispersed, so did the family atmosphere, but many former employees and colleagues, to this day, recall the feelings of inclusion and camaraderie involved in working for John Connell and Associates.

John Connell read widely and studied widely, all his life. Possibly he was an originator of CPD (Continuous Professional Development) as an obligation and a record of what you experience, learn and then apply. He certainly believed in CPD himself. In the 1960s he travelled widely, learning from consulting engineering firms overseas how to grow his practice and keeping abreast of the explosion of new knowledge. Under his leadership John Connell and Associates became one of the most successful consulting engineering firms in Australia, with widely diverging fields of practice. Connell brought in engineering experts from around the world to join the firm and help it grow. He set up possibly the first computer aided design division (Consuldata) in such an engineering practice, back in the days when most of us engineering students were still working with primitive software and punched cards! Consuldata was run as a computer bureau, used by other firms as well as Connell's. Its first programs were written in-house and run on a Control Data "mini" computer (the size of a large cupboard) with paper tape output. A flat (concrete) slab analysis program was one of the first in Australia, and a successor, written in 1975, is said to have still been in use 20 years later.

It would be quite impossible here to list all the important and innovative design contracts undertaken by the Connell practice. The earliest I have come across was a large, concrete framed, brick clad, saw-tooth roofed Woolstore in North Melbourne, built between 1956 and 1960. An ordinary looking building, but with a spare and economical design, eminently fit for purpose. Then there was the Frank Lloyd Wright style mini Guggenheim Museum that was the Brighton Municipal Offices opened in 1961. No matter what you think of the architectural design, and the bright pink bricks, the engineer must be credited with the fact that it is still as structurally sound as the day it was opened.

[See image at right, from the Heritage Council of Victoria.]



Another early job, a fascinating one that started soon after Connell took over the practice, and went on for some years, was the complete reconstruction of The Age newspaper building at 233 Collins Street, Melbourne, turning the ornate, five storey Victorian building, with a statue of Mercury gracing the pediment, into a 10-storey glass and concrete skyscraper, all happening around the reporters and printers and editors who continued getting out their newspapers every day despite the chaos they were working in. The main thing that concerned the builders was that they had to completely reconstruct the whole building, without causing the giant presses to stop for a single day. The General Foreman on the job told me how John Connell used to turn up every morning, almost without fail, for a thorough inspection of the previous days work, or to supervise anything important that was happening that day. A man dedicated to his work.



Sir Kenneth Luke stand at Waverley Park in 2006.  
Image: from Melburnian in Wikipedia.

Later jobs, mostly from the 1960s to the early '80s were diverse and growing in complexity. For instance, the structural design of Waverley Park football stadium was much admired and it became the forerunner of a number of other stadia around Melbourne designed by John Connell & Associates. The Heritage Council of Victoria had this to say:

*The high stand (the Sir Kenneth Luke Stand), designed in 1963 but not built until 1973-76, is of architectural (and engineering) importance as an early example of a reinforced concrete structure on this scale, and makes a design and architectural feature of this material. It employed the unconventional device of repeated large concrete scissors, or X, frames supporting large-span pre-stressed and post-tensioned concrete cantilevers for seating. This structural solution was recognised by a national merit award from the Association of Consulting Engineers, Australia in 1978, more than a decade after it was designed.*

<sup>1</sup> From John Peyton, who joined the firm in the 1950s and, as he said, became Connell's right hand man for the next 30 years.



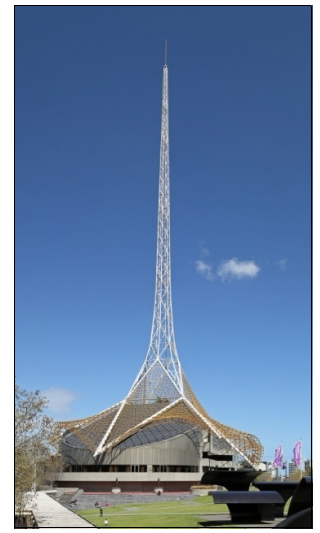
## Vale Dr John W. Connell, A.M., D.Eng.

Design of the grand Melbourne Arts Centre complex near the south bank of the Yarra started in 1961. It was a very long-term and complex job, stretching over more than 20 years. The first stage, the National Gallery, was pretty straightforward, built on solid rock footings. It was completed and opened in August 1968. The adjacent concert hall and theatres were originally planned to be in one building, largely underground, but complications caused by the horrendous conditions of their deep silt and mud footings brought years of delays while a solution was found and before the separate theatres building and concert hall were completed as we see them today. This must have been one of the most challenging and frustrating and yet immensely satisfying jobs ever undertaken by the firm.

Below: The Collins Place Towers in 1981 – from Skyscraper City. Right: Arts Centre Spire. Image: John O'Neill in Wikipedia.

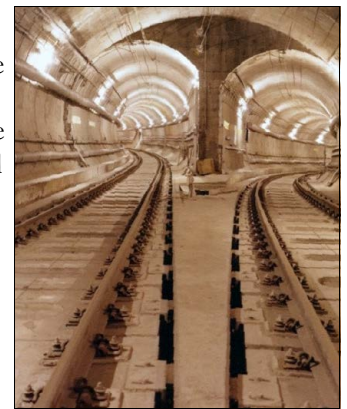


Parallel in time with building the Concert Hall was the construction of two office/hotel towers in Collins Place at the “Paris end” of Collins Street. The tallest buildings in Melbourne for a few years, until overtaken by the new Rialto a few years later, the towers and the plaza between them were “state of the art” when they opened in 1981 and have remained a popular address.

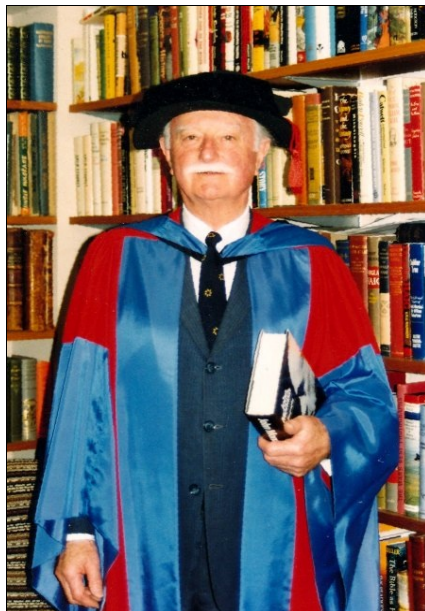


Two of the earliest major civil contracts the firm took on were first fruits of Connell's exploration of overseas consulting firms, new ideas, and the possibilities inherent in bringing together the world's leaders in engineering technology. The Eastern Waste Water Treatment Plant (ETP) was built to take sewage from the eastern suburbs of Melbourne and ease the burden on the historic Werribee treatment plant in the west. It was finished in 1975, and I think John would be pleased to know that the ETP has since become a major bird sanctuary, with bird-life monitored in monthly surveys.

In 1971 the Melbourne Underground Rail Loop Authority (MURLA) was set up to build the Loop and on 22nd June 1971 the first sod was turned in Jolimont Rail Yard. To construct the project, John Connell & Associates put together a consortium consisting of themselves plus three other engineering companies – from the United Kingdom, Canada and the USA – for design and supervision. The Loop was part surface level, partly on an elevated viaduct, with four separate tunnels comprising 10 kilometres of driven tunnels, three kilometres of cut-and-cover, and three underground stations. Flagstaff station was the last to be opened, on 27th May 1985. The Melbourne Underground is notable for its 'double sleeper' floating track system, solving the problem of ground transmitted vibration and track noise. Consequently, the loop is said to have some of the best designed and quietest underground stations in the world. Reminiscent of his days on the Age Building transformation, John Connell himself was involved in the supervision, and a frequent visitor to the various construction sites. And reminiscent of the days when he was a nipper, and taken around building sites by his uncle, his grandson Matt remembers being taken on visits to the *Melbourne underground during construction in the late '70s and early '80s. All engineering projects he was working on at the time [were] definitely exciting places to get inspired as a kid.*



Junction of two tunnels on the City Circle Line. Image: from PTV.



Dr John Connell in his doctoral robes, in his own library. Image: courtesy the Connell Family.

John Connell's colleagues, admirers and friends describe him as a creative lateral thinker; one who led from the front and set examples for others to follow; a great team builder; quick to recognise people's skills – and use them for mutual advantage; a compassionate and interested employer; generous in spirit; a valued mentor to young people; an entertaining raconteur; and more. He sat on many boards, has been a Grand Master of Freemasonry, and even a farmer in his spare time, but above all, he was an outstanding engineer.

That the engineering and academic communities value John Connell's contribution is evident in the honours and awards he has achieved: in 1980 he was awarded the prestigious Kernot Medal by the University of Melbourne; Monash University presents a John Connell Leadership Scholarship donated by his former company; the most important award given to eminent structural engineers by Engineers Australia is the John Connell Gold Medal; the theatre in the former head office of EA Victoria Division was named the John Connell Auditorium; in 1987 he was awarded Member of the Order of Australia, in recognition of his service to civil engineering and to the community; and in 1991 RMIT made him an Honorary Doctor of Engineering.

*from The Editor*



# Vale Brian Leonard McGrath, PSM. – 1937 to 2016.

Brian was born in Brisbane, the son of industrial chemist Leonard McGrath and school teacher Maureen McGrath, née Gormley. His primary education took place at St Joachim's Convent School Holland Park and he completed his secondary education at *Terrace* (St Joseph's College, Gregory Terrace, Brisbane).

Brian McGrath exhibited his inherent humility and modest self-assessment of his intellectual ability when, at age fifteen, he decided to cut short his secondary education and seek employment. Fortunately for Queensland and particularly for the Queensland engineering profession, the principal of *Terrace*, rang Brian with his Junior examination results to dissuade him from that course. *Terrace* was rewarded for that phone call by having Brian earn thirteenth place in Queensland for the Senior exam in 1954. For this result, Brian was awarded a university scholarship and appointed Engineering Scholarship Holder, Coordinator-General's Department.

In his Sub-Senior Year, he joined the inaugural post-war Terrace Rowing Team as cox of the Second Four. His love of numbers was evident even then when he calculated the stroke rate and best course to win the Novice Fours at the University of Queensland's 1954 Regatta.

After completing the four-year full-time course at the University of Queensland (UQ), he was awarded his Bachelor of Engineering (Civil). He later completed his Bachelor of Science in Mathematics in 1961.



Brian McGrath with Heather.

Noted engineers who influenced his early career included EM Shepherd, AH Britton, and Professor RWH Hawken, who was also the grandfather of Brian's wife, Heather.

Brian started with the Department of the Coordinator General of Public Works in 1959, with his first major project being the Barron River Hydro-electric Extension Project. He designed innovative eccentric pinned footings for the access bridge to the site, as well as designing the reinforced concrete underground power station. He analysed the two surge tank supply tunnels using a computer program. This may sound relatively simple these days, but at the time there were no computers in Queensland. Brian wrote the analysis program in binary code, almost certainly the first computer program written in Queensland, and ran it on the University of Sydney's SILLIAC computer. Following the success of this program, Brian advised the Committee that had been set up to purchase the first computer in Queensland for UQ in 1962.

Brian and Heather, née Arden, met at a Christmas party while she was studying at UQ. Although she was a country girl and Anglican and Brian was a city boy and Catholic, they overcame the perceived obstacles of that era and married in January 1968. Their union was blessed with three children: Toby, John and Juliet. Both boys went on to be engineers, while Juliet joined the police service.

In his early career, Brian developed an intense interest in coastal engineering. He was engaged in a range of coastal projects including dredging for the Port of Brisbane, installation of navigational aids in Moreton Bay and organisation of hydrographic surveying systems. He assisted in drafting the legislation for the Queensland Beach Protection Authority and was appointed engineer to this body at its inception in 1968. In 1969, Brian went to the Netherlands to work with the Delft Laboratory on investigations into the Gold Coast beaches. He assisted in the preparation of the Delft Report on Disposal of Sewage Effluent by Ocean Outfall at the Gold Coast and was a senior author of the Delft Report on Coastal Erosion and Entrance Stability Problems at the Gold Coast. These landmark investigations led to the construction of a range of works to address the severe erosion at the Gold Coast.

Returning from the Netherlands, Brian was greeted with the news that he and the Beach Protection Authority were to be moved to the Department of Harbours and Marine (H&M). After the move, Brian was transferred to a new branch dealing with the provision of facilities for small craft, including boat harbours, jetties, boat ramps and navigation channels throughout the state. In 1981, Brian was appointed Principal Engineer for Works and Services, and oversaw a range of projects including new coal ports at Abbot Point and Dalrymple Bay; the Townsville, Cairns and Thursday Island H&M Department Operations Depots; the Townsville Fishing Marina; and, major dredging exercises at Weipa. During this period, Brian supervised the production of a comprehensive history of the H&M Department's Harbours & Marine, Port & Harbour Development in Queensland from 1824 to 1985.



## Vale Brian Leonard McGrath, PSM. – 1937 to 2016.

In 1988, Brian was appointed Director of Engineering Services for H&M, also functioning as Deputy Director of the Department, Engineer to the Beach Protection Authority, chaired the Queensland Government Hydraulics Laboratory Advisory Board and the Government's Coomera River Waterways Committee and was Superintendent for the Department's construction contracts. In 1989, the Department of Harbours and Marine was broken up with responsibility transferred to a number of other departments. Soon after, Brian retired from the Public Service after a career spanning thirty-six years.

Engineers Australia Queensland benefited from Brian's efforts and expertise as a member of various subcommittees from 1971, culminating in Brian being elected to President of the Engineers Australia Queensland Division in 1988. He also delivered over twenty papers on various issues within his area of expertise. For his work in the engineering profession, Brian was awarded the Public Service Medal in the 1992 Australia Day Honours List.

In his retirement, Brian and Heather were active within the Royal Geographical Society of Queensland and have enjoyed four-wheel driving, camping, fishing, and their holiday home at Tin Can Bay. He also enjoyed playing golf and tennis.

Brian was recruited to the Engineering Heritage Australia Queensland (EHAQ) Panel in 2006. Naturally, he became a very active member holding various executive positions, and was a member of the EHA Board for four years. His travels around Queensland on scouting trips for engineering heritage sites resulted in many EHA Award Markers, with accompanying interpretation panels, without his contribution being formally acknowledged.

He was known for his work ethic and humility and was always ready to assist with any project, adding his knowledge and expertise without criticism. The driving passion for his involvement was the desire for professionalism to be evident in the output. For Brian, this required accuracy in the data published and for it to be expressed to the highest standards of English grammar. Even in the later stages of his battle with melanoma, he produced an article for the Engineering Heritage Magazine, of which EHAQ can be proud.

Brian will be sadly missed for his humility, diligence, generosity, intelligence and passion. Brian is survived by his wife Heather, sons Toby and John, daughter Juliet, grandchildren Isabelle, Caitlin, Erin, Hugo, Ned and Flynn, and sisters Lynette, Elizabeth and Maureen.

*Brian McGrath's school friend Secretary of EHQ Brian King, MIEAust(Ret) and Brian's son Toby McGrath, MIEAust, CPEng pay tribute to a truly great man.*

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The obituary above was first published on the Engineers Australia website on Friday 12<sup>th</sup> August 2016, soon after Brian's death on 5<sup>th</sup> August. What an extraordinary man! Most of us in EHA had no idea of the distinguished career he led before he became involved in engineering heritage. I am in awe of his brilliant facility in mathematics. He was not only a leader in the very mathematical discipline of coastal engineering, but he was also a pioneer in applying his mathematical skills to computer programming. He came to engineering heritage late, but in the few years he has been with EHQ, he seems to have galvanised the group. He himself said, in an email send to us southerners just 10 days before he died:

*I have really enjoyed my interactions with EHA over the past years - I am rather passionate about Engineering Heritage, indeed anything engineering I tackle. I joined EHQ at the cajoling of my dear friend the late Robin Black in 2006, joining with little knowledge of engineering heritage and no knowledge of Heritage Engineering - the latter hasn't changed! Robin advised me that I was then old enough to be interested in Heritage. I have given a lot I reckon to EHQ, being its Treasurer from 2008 - 2014. Starting up and co-ordinating the EHQ website has been another activity of which I am very proud. I am also proud of the fact that I introduced at least 3 engineers to EHQ and all are proving great contributors to EHQ.*

Brian has been one of the most solid and constant supporters of EHA Magazine since I first met him at the EHA Conference in Canberra in November 2013. He has contributed to 8 of the 10 magazines published so far, either with a story about his travels or his research, or providing abundant and invaluable information to assist me in Queensland stories I was developing. After I published a story about the Rockhampton Railway Roundhouse, and suggested it should be recognised by EHQ, he found an engineer who had worked there to prepare a nomination document. The last thing he did for me, on 12<sup>th</sup> July, a month before he died, was to contribute a progress report from EHQ for the July Magazine – the first such progress report from a Division, that we both hoped would inspire similar articles from the other Division's EH Committees. He will be greatly missed.

Goodbye Brian – *The Editor*



Brian McGrath and Andrew Barnes at the recognition ceremony for the Blackall Woolscour in 2014.  
Image: EA website, probably from Brian's camera.



# *Review – With Power & Purpose, by Maxwell G. Lay.*

## *How 19<sup>th</sup> century transport innovators totally changed the way the world operates.*

The author, Professor Max Lay AM is a recognised expert in the fields of structural engineering, road and transport engineering, the history of engineering, and information technology.<sup>1</sup> In 2014 he was awarded the Peter Nicol Russell Memorial Medal, Engineers Australia's highest award for career achievement.

I found his latest book to be a fascinating journey through 19<sup>th</sup> century innovation, engineering, economics, politics and personalities. The book moved from 18<sup>th</sup> century horse drawn and pedestrian traffic reliant on an engineered network of canals, through the industrial revolution to motorised rail and road transport enabling an economic and social revolution.

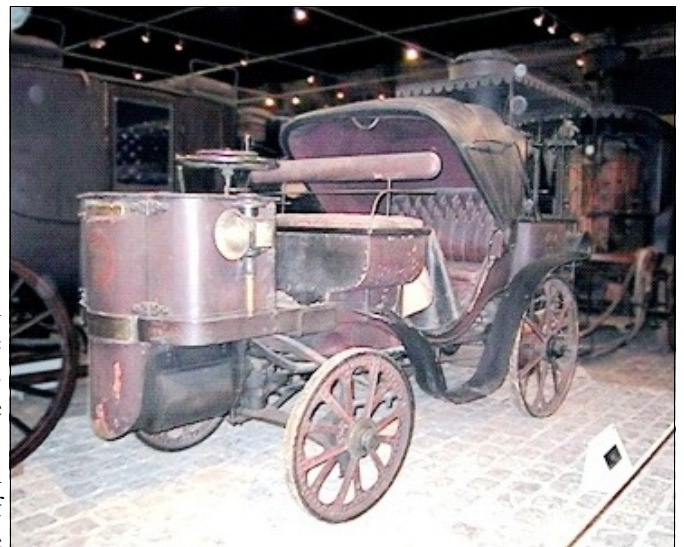
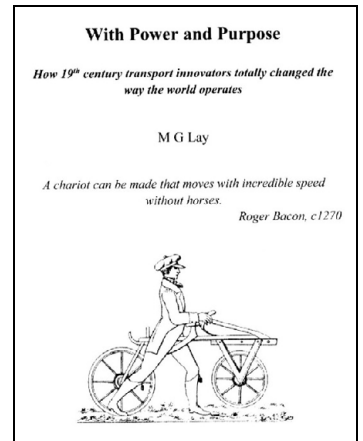
It concentrates largely on the UK, while drawing comparisons with developments in Europe and the US. It is the equivalent of a 300 page book, but being published on Kindle,<sup>2</sup> the pages are unnumbered for the flexible format of an eBook. It is heavily referenced with more than 200 documents quoted and 780 endnotes along with 108 illustrations. The structure is unusual in that in the absence of page numbering, the 22 chapters are for the most part divided into sub-sections which are frequently cross referenced in the text.

The book does not require a high level of prior knowledge as, for example, it explains the production, metallurgy and properties of cast iron, wrought iron and steel, on which machinery production depended. Beyond this exposition it repeatedly draws connections between the available technology placing restrictions on what inventors can achieve, while the expanded application of their innovation brings about improvement of the associated technology, enabling further advances. Lay referred several times to such relationships between engine innovators and iron foundries as incestuous, while I would prefer to think of it, without the negative connotations, as symbiotic.

A wide range of interconnected social and economic factors are discussed that plot the progress in transport technology and its impediments. Some connections are more obvious than others, for example the land area required and cost of feeding horses as a factor in the competitiveness of a railway. And while their construction was more subject to grade and curve constraints than roads, the greatly improved speed of transport for mail and inter-city travel was a key point in favour of steam railways. Yet horse-drawn barges on canals remained viable for freight that was not time critical. And while railway lines were not easily constructed into city centres, competition from the more manoeuvrable steam cars and buses was minimal because of their unacceptable size, wheel damage to existing roads, smoke and perceived danger to other road users. This perceived danger (sometimes real when boilers exploded), led to 1865 legislation requiring a red flag to be carried at walking pace in front of motorised carriages. This constraint remained in place for more than 30 years in Britain until internal combustion vehicles developed in France, Germany, and America became established. Vested interests in toll roads, patent restrictions and squabbling between rival inventors also inhibited the development of a British 19<sup>th</sup> century car industry, in contrast with the earlier boom in railway construction.

While external factors are well explored in the book, technological developments are not taken for granted. Contributions of technologies are analysed relating to stationary steam engines, horse drawn carriages, bicycles, roads and bridge construction, railway tracks, steam locomotives, cable trams, steam ships, electrical power, pneumatic tyres, steering arrangements, and internal combustion engines.

The book concludes with a discussion of the context of change and the huge impact of 19<sup>th</sup> century inventions, which in some cases have only had incremental improvement in the 20<sup>th</sup> century. Lay's proposition is that progress can't be predicted or expected to be linear. Sometimes it is exponential when one invention inspires related improvements or further inventions. Yet changed circumstances can cause a loss of momentum or a change of direction, as happened to steam powered vehicles with the development of internal combustion engines.



Bolle's "La Mancelle" 1878 steam car, shown in the book. Image: Wikipedia.

I commend the book for an expanded insight into the industrial revolution, for the modest investment of US\$3 on Kindle.

*Keith Baker, October 2016*

<sup>1</sup> <https://www.arrb.com.au/Home/ARRB-history/ARRB-Hall-Of-Fame/Professor-Max-Lay-AM.aspx>

<sup>2</sup> Kindle ebooks are published by Amazon.com and can be read on a Kindle device or most smartphones, tablets and computers using a free Kindle reading app available on line.



# Connections



Ken McInnes sent a link to a preview of an in-production movie from ASCE (American Society of Civil Engineers). The movie ? ASCE - Dream Big: Engineering Wonders of the World  
In case you haven't seen this preview of the in-production ASCE movie yet, see <http://news.asce.org/asce-convention-to-offer-a-dream-big-sneak-peek-at-opening-welcome-reception/>  
The movie aims to translate engineering into an entertaining, inspirational film experience.

For anyone who would like to know what sort of things TICCIH has been doing, former TICCIH Bulletins , from Number 24 – Spring 2004 to number 68, 2015 No. II, can be downloaded free from <http://ticcih.org/publications/>



More than 60 surviving ships that participated in the First World War are featured on this rather odd website maintained by National Historic Ships UK. Clicking on a location map brings up a history of each ship and should bring up a current photograph – although no photo appeared on my screen. To see the images, click on Menu and then Vessels. The site also includes a timeline and thematic essays. Go to *The First World War: Britain's Surviving Vessels* ( [www.ww1britainssurvivingvessels.org.uk](http://www.ww1britainssurvivingvessels.org.uk) ).

*History Begins with A Road* is a book that was produced by the NSW Department of Roads & Maritime Services (RMS) in about 2013. RMS tells us “the book quickly became the definitive Historic *Old Hume Highway* Touring Guide from Sydney to Albury”. As any of you who (like me) have been travelling the NSW end of the Hume Highway for 50 or 60 years will know, the road has changed beyond recognition, and how much of it you would still find by following the maps is a bit problematic. However there's lots about the now by-passed towns and villages along the way. Download it as a PDF at:

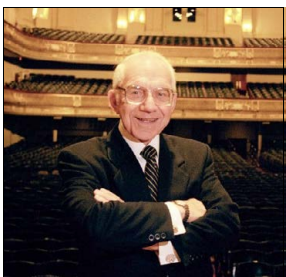
<http://www.rms.nsw.gov.au/documents/projects/south-western/hume-highway/history-begins-with-a-road.pdf>



Another view of roadways and road making from RMS. Harry Trueman sent a link to a video of a 1928 silent film about the construction of the Adamstown to Swansea section of the Pacific Highway. It takes you back to the days of men with picks and shovels and horses with draglines and scoops. But wait! There's more! The same link gives you access to half a dozen other NSW historic road making films. Have a look at:

[https://m.youtube.com/watch?v=uMF43rm0rg0&list=PL77005Dcc\\_Nr\\_HnXRFfm5h4ys-i4cJKI](https://m.youtube.com/watch?v=uMF43rm0rg0&list=PL77005Dcc_Nr_HnXRFfm5h4ys-i4cJKI)

Remember Steam Tug *Waratah* that I wrote about in Notes & Queries in the July 2016 issue of this magazine? She is one of the prize repair and restoration jobs of the Sydney Heritage Fleet (SHF). In the July 2016 Magazine I put in a link to a thesis written by Mori Flapan – *Restoration of the Steam Tug 'Waratah'*, for the UNSW School of Mechanical & Industrial Engineering. Here's the link: [http://www.boatregister.net/Library/Maritime%20History/WaratahThesis\\_Flapan\\_1980\\_Optim.pdf](http://www.boatregister.net/Library/Maritime%20History/WaratahThesis_Flapan_1980_Optim.pdf)  
However, while looking for some images of *James Craig* on the SHF website, I found a reference to a book : *Tug 'Waratah'—a Century of Steam* written by Mori Flapan to commemorate *Waratah's* 100th year. The webpage <http://www.boatregister.net/WaratahBook.htm> gives details how to buy it.



The *New York Times*, 17 Oct 2016, *Leo Beranek, Acoustics Designer and Internet Pioneer, Dies at 102* – an obituary found at [http://www.nytimes.com/2016/10/18/business/leo-beranek-dead.html?\\_r=2](http://www.nytimes.com/2016/10/18/business/leo-beranek-dead.html?_r=2)

My daughter knew I was researching the life of John Connell, and she thought I would be interested in the life story of another amazing centenarian engineer. I was, and I thought some readers might be too. Born in the mid-west USA, Beranek gained a graduate scholarship to Harvard engineering school and became an assistant professor and an expert in acoustics. As a consultant after WW2 he changed direction and became a pioneer in computer software research and development and developer of Arpanet, the precursor to the Internet. A fascinating life!



