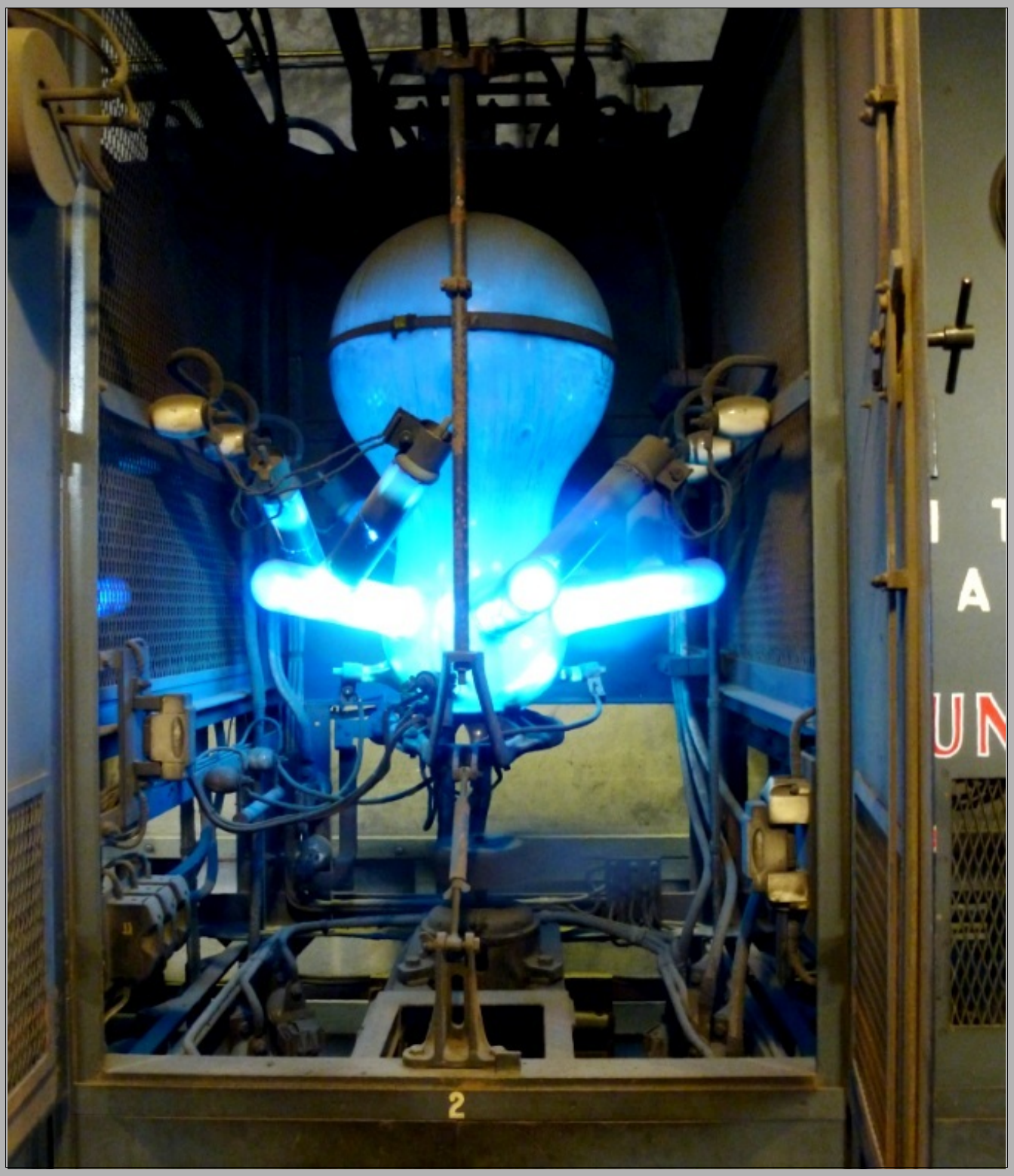
ENGINEERS AUSTRALIA

# EHA MAGAZINE




Engineering Heritage Australia Magazine Volume 3 No.5 May 2020

# Engineering Heritage Australia Magazine

May 2020
Volume 3 Number 5

EDITOR:
Margret Doring, FIEAust. CPEng. M.ICOMOS

The Engineering Heritage Australia Magazine is published by Engineers Australia's National Committee for Engineering Heritage. Statements made or opinions expressed in the Magazine are those of the authors and do not necessarily reflect the views of Engineers Australia.

Contact EHA by email at:
EHA@engineersaustralia.org.au
or visit the website at:
https://www.engineersaustralia.org.au/Communities-And-Groups/Special-Interest-Groups/Engineering-Heritage-Australia

Unsubscribe: If you do not wish to receive any further material from Engineering Heritage Australia, contact EHA at :
EHA@engineersaustralia.org.au

Subscribe: Readers who want to be added to the subscriber list can contact EHA via our email at :
EHA@engineersaustralia.org.au

Readers wishing to submit material for publication in the Engineering Heritage Australia Magazine, can contact the Editor via email at :
EHA@engineersaustralia.org.au

Cover Images:

Front: Glass bulb mercury arc rectifier in operation at Brunswick West Tramway Substation 'W' in 2014. The eerie blue glow from the device is characteristic of this form of rectifier.
Photo: Miles Pierce.

Back: The cover and a sample page from the St Helena Washaway Photo Album.

The album survives in the SRA Reference Photo Collection in the NSW State Archives (SARA). The bindings have been dismantled for scanning.

SARA NRS 17420_2_1684_140_002

ISSN 2206-0200 (Online)

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

## CONTENTS



## *Connections*

Just a few websites this time, for your interest and entertainment.

### *Industrious Light:*

If you've ever wondered how those painters of giant murals on buildings and silos go about their work, here is Philadelphia artist Phillip Adams depicting the city's industrial past on its present walls: https://www.muralarts.org/artworks/industrious-light/

### *Photography and Corporate Public Relations:*

The Case of U.S. Steel, 1930–1960. This is an extensive photo essay on U.S. Steel by the Harvard Business School, arranged in several different topics: https://www.library.hbs.edu/us-steel

### *Big Stuff 2019 in Katowice, Poland:*

The 6th Big Stuff conference theme was *Preserving Large Industrial Objects in a Changing Environment*. A selection of the presentations are available on the website, including one about the *Restoration of the Steam Ship John Oxley*, for the Sydney Heritage Fleet.
https://bigstuff.omeka.net/exhibits/show/conferences/bigstuff-2019

# *Editorial*

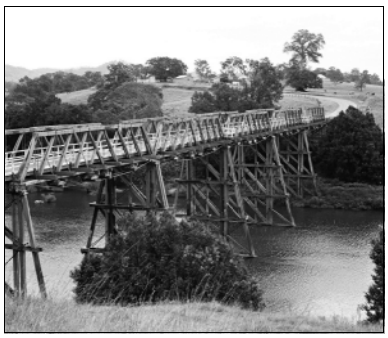
Not long ago I heard via an email chat group of the death of Ray Wedgwood, former Chief Bridge Engineer of the NSW Roads and Traffic Authority (the RTA, previously Department of Main Roads, now Roads & Maritime Services). It was quite a shock to me to hear of his death like that. You don't expect this to happen suddenly to old friends, and he was several years younger than me! I found his obituary in the Sydney Morning Herald, tracked down the author, Rob Wheen, and wrote to him, asking if we could re-publish it in this magazine. He was pleased with that idea and sent me his original document (before it was edited by the SMH) plus a number of photographs. The obituary (see page 7) remains substantially as Rob wrote it, with some minor editing by me, and I added a few relevant bridge photographs that I found.

I wanted to write something more about Ray – how he came into my life and what a positive effect he had on my career as a heritage professional. Rob Wheen writes as if Ray's interest in heritage conservation came quite late in his life, perhaps after his retirement, but I can establish his active involvement in heritage conservation – particularly in bridges of course – at least 20 years earlier than his retirement, and possibly sometimes in a manner almost subversive of his employment as a senior bridge engineer with the NSW Department of Main Roads (DMR). My observation of Ray as a design engineer was of his modest ego, and his great respect for his forbears, which probably grew from his interest in and respect for the history of his profession.

Here, I would like to record some of the ways Ray helped me in my heritage work. One of the ways was his ability to distinguish between the possible and the impossible. He knew when to go on fighting and when to give up and step back, and he helped me to understand that. I had similar feelings about his colleague Brian Pearson whom I also think of as an old friend, even though we haven't met for many years. Rob Wheen describes Brian and Ray as "this formidable duo" I don't know how long they had been working together before I met them, but they were certainly a formidable duo back then.

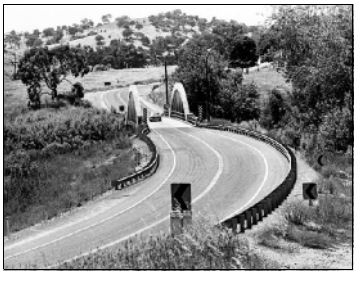
I joined NSW Department of Planning, Heritage Branch, in 1984, as "The Engineer" for the NSW Heritage Council – a new and very strange animal in those days, in more ways than one. It was a while before they worked out how to use my professional knowledge to advantage. I remember an early job was driving down the coast from Sydney to nail a Section 136 Order on the doors of a church (a cease and desist order from the NSW Heritage Act, 1977) addressed to the pastor who had been digging up gravestones in the churchyard (relics) and piling them against a fence! I felt a bit like Luther in Wittenburg.

The Department soon found something far more suitable for me. I was sent to join the DMR/National Trust Bridges Committee as the Heritage Council representative. Brian (then DMR Chief Engineer Bridges) was the Chair, and he and his offsider Ray greeted me with enthusiasm. At last! An engineer instead of more architects! The committee sat round a big table in the DMR City offices, and every month we dealt with a solid agenda and a wide range of problems, large and small, spread over an enormous area. It was a great education for me in the geography and infrastructure of a state larger than some countries, and invaluable experience when I started travelling the state myself under the auspices of the Heritage Branch. I was not a native of NSW, and had never even crossed the border from Victoria until in my mid-twenties!



I didn't always see eye to eye with Brian and Ray, but they were on my side more often than not. I failed to win them over in the case of the saving the big timber Allan truss Killawarra Bridge over the Manning River near Wingham – with justification, I later understood. It was much loved – even famous – for its history and its size and great height. That one was just too difficult to conserve, after monster floods in 1979 had damaged it, and it was ultimately replaced with a boring concrete bridge alongside, then demolished. That had to be, because left in situ it would have been a danger to the public.

A typical small problem (ie physically small) was saving the so-called Little Sydney Harbour Bridge – a reinforced concrete, bowstring arch bridge over Hillas Creek on the Hume Highway near Gundagai. This little masterpiece was threatened with routine demolition by the DMR after it was to be bypassed in re-alignment and doubling of the Hume Highway. When it could be shown that it was as solid as a rock and could remain so for a hundred years, the DMR bureaucracy retreated, and it was left to stand in a neighbouring farm paddock, saving generations of cattle from having to scramble up and down the Creek bank. Until recently, it could be seen by north-bound travellers on the Highway – a object of wonder to many.



One of my major problems in those years was trying to save the Echuca-Moama Road-Rail Bridge, across the Murray River on the NSW/Victorian border. Ray and Brian were a wonderful help to me in that battle. This great iron bridge was built by the Victorian Government in 1878 to carry road and rail traffic across the border, but in the 1980s the Victorian Railways wanted a new rail-only bridge, to carry heavier trains with bigger loads of grain to port in Melbourne. Ultimately we defeated VicRail, and the bridge still stands, but it was a mighty struggle and a fascinating story (which I must write up soon).

*Margret J. Doring, FIEAust., CPEng., M.ICOMOS.*

Photos: Killawarra Bridge (left) and Hillas Creek Bridge (right) are both by the editor circa 1984.

# *Engineering Heritage WA and Honorary Fellows*

*By Mike Taylor and the Honorary Fellows.*

Honorary Fellow is Engineers Australia's highest membership grade. It is conferred on a Fellow of Engineers Australia whom the Board desires to honour for having rendered conspicuous service to the Australian people or in recognition of outstanding achievement. Recipients are announced annually and included in the 2019 announcement were two long-standing members of Engineering Heritage Western Australia (EHWA) – Ian Maitland and Don Young.

## *Ian Maitland*

Ian grew up in Adelaide and graduated with an Honours Degree in Civil Engineering from the University of Adelaide in 1962. In the first several years after graduating he worked in Adelaide, Melbourne, Montreal and London as a structural design engineer. His career highlight of this period was designing space frame structures for Expo 67 in Montreal. On return to Australia with his wife Ursula, Ian settled in Perth where he first worked as an in-house engineer with a firm of architects. Then for twenty years he was Manager, then Managing Director, of the WA Office of John Connell & Associates, consulting engineers, now Aurecon.

Ian Maitland visits his work site at the Bishop's Palace, Perth in 2010.
Source: Ian Maitland.

In 1990 Ian set up his own practice as a structural engineer, later specialising in heritage engineering under the name of Maitland Heritage Engineering (MHE). Ian & MHE have won numerous project and individual awards including for the structural conservation of St George's Cathedral, Trinity Church & the Land Titles Office, all in Perth City. Ian has undertaken more than two hundred heritage projects, written numerous technical papers and delivered many presentations to industry, professional and community groups.

Outside of engineering practice Ian was an Australian Army trained demolition expert and had a 35-year involvement with Rotary including past president of the Karrinyup club and a Paul Harris Fellow. In the 2000s, Ian served on the Rottnest Island Cultural Heritage Advisory Committee and advised on the conservation of the WW2 guns, tunnels and military infrastructure including the battery observation post. It is fitting that one of Ian's voluntary activities is serving as a Rottnest Island guide.

Within EHWA, Ian initiated and prepared the course material for an education program in Heritage Engineering, the first ever in the country, culminating in a successful training day in November 2017. Ian has updated this course material, which is now being used by Engineering Heritage Australia and the University of Canberra to prepare an online course, enabling engineers to receive registration in Heritage & Conservation Engineering.


Ian Maitland (at left) is presented with his Honorary Fellow certificate by Engineers Australia Western Australian President Paul Young.
Source: Engineers Australia.

Prior to retiring three years ago Ian was one of five engineers in the country with registration in heritage and conservation engineering. He was awarded the John Monash Medal 2012 for outstanding contribution to engineering heritage, and the Order of Australia Medal (OAM) in 2016 for service to Cultural Heritage and Civil Engineering.

Ian has been a member of EHWA since 2008, was Chair in 2015 and 2016 and a member of Engineering Heritage Australia's national committee. Ian retired from EHWA in December 2019 but when needed continues to provide assistance.

He continues to give presentations to professional and community groups. This year Ian was scheduled to deliver a series of lectures in heritage engineering to University of Western Australia School of Design students, and to provide walking tours of his heritage conservation work in Perth. Unfortunately these activities have been postponed until 2021 due to the corona virus pandemic.

## *Don Young*

Don won a Commonwealth Scholarship to the University of WA and graduated with An Honours Degree in Civil Engineering in 1955. He joined J. O. Clough and Son in 1957 to work in the Christiani and Nielsen Clough joint venture for the construction of Perth's original Narrows Bridge. In November 1999 this bridge was recognised by the Engineering Heritage Program as a National Engineering Landmark.

After the completion of the Narrows Bridge in November 1959 Don travelled overseas and worked in the design offices of Christiani and Nielsen in London and Copenhagen. On return to Australia in October 1961 he was assigned to another Christiani Nielsen Clough joint venture as Deputy Project Manager on the site of the Ord River Diversion Dam at Kununurra. In 2013 this project was also recognised by the Engineering Heritage Program as a National Engineering Landmark.

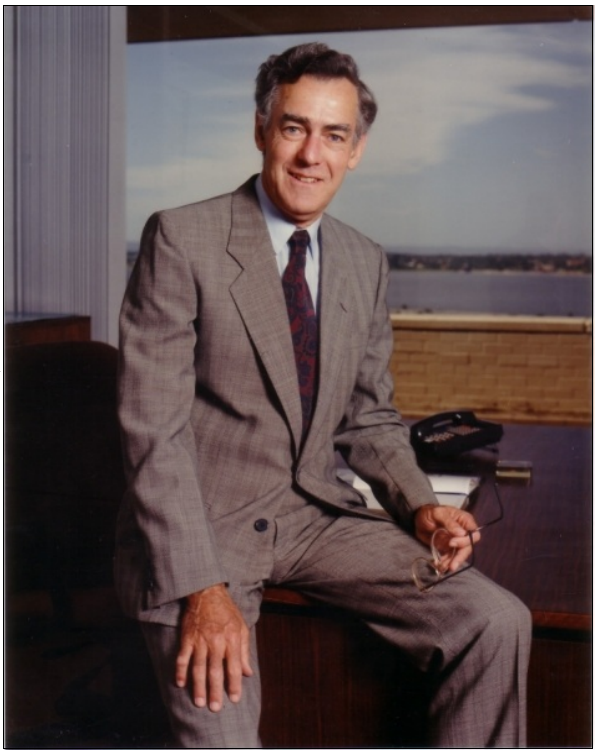
In his subsequent career with Clough Engineering, Don was Clough Kier Project Manager for the construction of the central section of the Mitchell Freeway Stage 1, comprising Malcolm, Hay and Murray Streets bridges and retaining walls and freeway standard roadway pavements. The Mitchell Freeway Stage 1 was recognised as a National Engineering Landmark in 2008.

Don Young (left) celebrating the award of National Engineering Landmark to the Narrows Bridge, with his old friend Bent Schou of Christiani & Neilsen, at the Narrows site in November 1999. Source: Don Young.

The Stirling Bridge – the Stage 1 upstream row (left) is completed, and the downstream row units are placed, but not stressed. Source: Don Young.

Clough Engineering also constructed the Stirling Bridge at East Fremantle where Don was responsible for the detailed engineering and construction supervision of 292 precast concrete beam units which were cast in Clough's Kewdale precast yard and then assembled on site. In 1974 this bridge received an award for Excellence in Concrete from the Concrete Institute of Australia and in 2014 it was awarded an Engineering Heritage Marker by Engineering Heritage Australia.

Image Below: Don Young, a Director of Clough Engineering in 1990. Source: Don Young.



In preparing the successful tender for the original Mt Henry Bridge at Mt Pleasant, Don conceived a novel cable stayed falsework system for supporting the precast concrete beam units before post tensioning, obviating the need for installing and removing temporary support piling. In 1981 the falsework system was given an Engineering Excellence Award by Engineers Australia Western Australia Division.

On retiring from Clough in 1993 Don was appointed to the Board of the Water Authority of WA and the Water Corporation of WA when it was established in 1996, a position he held for seven years.

Don has been involved in volunteer work for the National Trust's Golden Pipeline Museum at Mundaring Weir since 2005. He liaised with the National Trust and Dr Richard Hartley who researched and wrote the story of the Goldfields Water Supply published in 2007 and titled *River of Steel.*

## *Engineering Heritage WA and Honorary Fellows*

In Australian Engineering Weeks 2009 and 2012 Don organised and led very successful public bus tours of Perth's major bridges. Don's extracurricular contributions are many, but particularly significant was his involvement in the development of the sport of orienteering where he played a major role as an administrator as well as being a successful competitor at state, national and international level.

Don joined the Heritage Panel of the WA Division of Engineers Australia (now EHWA) in 2003 and was Chair from 2008 to 2011. During 2008 and 2009 he worked extensively on a successful nomination to have the Goldfields Water Supply given the prestigious International Historic Civil Engineering Landmark award by the American Society of Civil Engineers. As a result of his work in identifying and preparing nominations of sites for engineering heritage recognition, in 2009 Don was awarded the Engineers Australia Medal for meritorious service.

In 2012 Don was given an Award of Merit by Engineering Heritage Australia in recognition of his outstanding contribution to the conservation of engineering heritage. In 2016 he was awarded a WA Division Medal by Engineers Australia for his significant work undertaken in support of Engineering Heritage WA. Don led Western Australia's contribution to the Engineering Heritage Recognition Program and has been involved in at least eight nominations. Don retired from the EHWA committee in early 2017 after nearly 15 years, but during retirement prepared two entries for Engineers Australia's centenary book, namely the *Goldfields Water Supply Western Australia* and the *Ord River Irrigation Scheme.*

Engineering Heritage Australia congratulates Ian and Don on the award of Honorary Fellow. Ian and Don are not the only Engineering Heritage committee members who have been awarded Honorary Fellow. Here in Western Australia others include Bruce James and Mark Bush, while in other states a notable member is Owen Peake. However the contributions that led to the award of Honorary Fellow for Bruce, Mark and Owen were generally for achievements outside of Engineering Heritage. What makes the award to Ian and Don so special is the recognition by Engineers Australia of the importance of the work by Engineering Heritage Australia and the contribution that heritage engineering makes to community welfare and the knowledge base of the profession.

---

## *Saving Western Australia's Engineering History – The new EHWA website.*

***From the Editor.***

In the September 2019 issue of EHA Magazine I reported that the *Western Australian Institution of Engineers Proceedings can now be downloaded from links to the Battye Library on:* https://portal.engineersaustralia.org.au/news/saving-western-australias-engineering-history
The Western Australian Institution of Engineers (WAIE) was one of the predecessors of the national Institution of Engineers Australia (EA), which celebrated its centenary last year. WAIE was founded in 1909 and lasted just on 10 years until taken over by the Western Australian Division of the new national institute. In that time the members produced an amazing collection of technical papers of relevance to engineering in WA, which were published in 10 annual volumes of Proceedings. I was eager to look at some of these papers, but accessing them via the website of the State Library of Western Australia (aka the Battye Library or SLWA) was an incredibly tedious process. Even after I had worked out how to download the volumes of the Proceedings, I didn't go ahead – the process was taking far too long. And then, in February 2020 I welcomed an email from Mike Taylor, a member of the Engineering Heritage Western Australia (EHWA) Committee. An edited version of that email follows:

> "EHWA WEBSITE – On 10 December 2019 EHWA launched a website at http://ehwa.wikidot.com So that the EHA National Committee was briefed on this development, Karen Riddette and I [Mike Taylor] drafted a report that was included in the agenda papers for the EHWA meeting held on 12 February. While there is only one website, there are two outcomes. The first outcome is a wiki type website providing a history of engineering in WA, the second outcome is a digital version of a Perth CBD Walking Tour that can be used on mobile phones, see http://ehwa.wikidot.com/places:perth
> "WAIE PROCEEDINGS — Because we now have a website, we are no longer dependent on the SLWA to provide access to Engineers Australia material. Our new website has several pages providing information on the Western Australian Institution of Engineers (WAIE): Story of the WAIE organization – http://ehwa.wikidot.com/orgs:waie WAIE Committee members – http://ehwa.wikidot.com/people-list:waiecommittee WAIE World War I Honour Roll – http://ehwa.wikidot.com/people-list:wwi-honour-roll WAIE Proceedings – http://ehwa.wikidot.com/events:papersinwaie
> "Each of the volumes of Proceedings is available to download as a .PDF compressed file with a brief listing of contents and authors available on the webpage. After compression, the .PDF compressed files range from 9MB to 22MB in size, a realistic size for users with an NBN connection. Hopefully this option removes your access frustrations.

The report mentioned above, sent to me by Mike, was a very interesting history of how the EHWA website was developed, by Mike, Karen and several others. A magnificent effort - congratulations to all concerned. Some background to the website can be found on the *About EHWA* page at: http://ehwa.wikidot.com/main:about But the real meat, which would be extra valuable to anyone thinking of setting up such a site, is in the text of the paper itself. A direct link to this is:
http://ehwa.wdfiles.com/local--files/main:about/EHWA%20Website%20Development%20-%20Paper%20for%20EHA%20Meeting%202020_02_12%20Ver%202.pdf

# *Ray Wedgwood, NSW Bridge Engineer*
# *27 May 1942 to 5 March 2020*

Ray Wedgwood atop the Sydney Harbour Bridge - and note the Harbour Bridge (a favourite place) on his tie. Photo supplied by Rob Wheen.

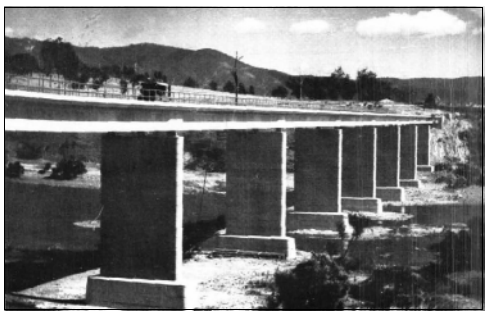
A passionate bridge engineer, a lover of music, a lover of sport, a devoted family man and a clear-eyed devotee of engineering heritage matters. Ray Wedgwood was all of these. Ray's funeral on 12th March 2020 heard tributes from many members of his family. They painted a beautiful word-picture of the man that all present knew, respected and loved. There was also mention of what Ray's parents always referred to as "Ray's Bridge" at Mount White, the first he had worked on designing as a fresh civil engineering graduate.

Ray was born in Dorrigo, NSW. His parents were Jack and Clare (nee Giddins) Wedgwood. Jack was an apprentice builder and rugby league player who played for St George as fullback in the winning Premiership team in 1941. His mother, Clare, was a talented seamstress and milliner. The Wedgwood family can trace their lineage back to Thomas and Josiah Wedgwood, famed for the Wedgwood pottery. Interestingly, Josiah's daughter Susannah was the mother of Charles Darwin.

The family moved to Bellingen where Ray started school in 1947. Growing up in Bellingen was an idyllic existence with swimming in the river and exploring the surroundings on his bike with his dog in tow. With his father, now running a dry cleaning business, he took part in the Bellingen Town Band. Here were the beginnings of his love of music and his ability to play the trumpet. The nearest high school at that time was Coffs Harbour High School (CHHS). Getting there involved a bus ride to Raleigh and then a four-carriage train that used to run from Macksville to Coffs Harbour. The steam engine 1310, an NSWGR Z13 class, that pulled the train was universally known as "Old Misery".

Ray met his beloved Carol at CHHS. Ray was an all-rounder; excellent at sport, a first-rate scholar particularly in the sciences and mathematics and a good-looking young man as well. He was an obvious choice for School Captain. It is fair to say that there were many female students who hoped they would catch his eye, but it was Carol who did that.

Study for the Civil Engineering degree at the University of Sydney was supported by a Traineeship from the Department of Main Roads (DMR). During the summer breaks Ray spent time in various Divisional and Works Offices in Grafton and Billinudgel. There were such a variety of experiences including surveying, rock quarrying, roadworks and bridge maintenance. However, it is fair to say that his time spent on site at the Mann River Bridge, Jackadgery, was seminal. Not only were the seeds sown for an interest in this early example of prestressed concrete but a more general interest in bridges. This interest blossomed into a lifelong passion for bridges.



Images - Left: Mann River Bridge under construction c1960. From facebook - Mann River Caravan Park.
Centre: The bridge after opening in 1961 – from the DMR Main Roads Jnl Vol 27 No 2 December 1961.
Right: A 2007 photograph of the Mann River Bridge, looking as good as the day it was built - Photo: Paul Rands in "Road Photos" on the internet

At the time of Ray's studies the Gladesville Bridge was under construction in Sydney. Gladesville Bridge was then the world's longest span concrete arch bridge. It was a privilege for a trainee to be present at one of the most astonishing feats of engineering; the lifting of an arch rib from its falsework using flatjacks. Site visits were arranged for the final year students who marvelled at the work that was being achieved. His interest in bridges by now was irresistible.

Upon graduation Ray was appointed to the Bridge Design Section supervised by Alleyne Smith. It was here that he worked on the curved Mt White Bridge mentioned earlier. It was the first among many. Bridge design is an exacting task requiring both imagination, skill and determination. At the time the calculations had to be carried out meticulously by hand and they and the drawings thoroughly checked.

Image above: "Ray's Bridge" – half of it, over the north-bound lane of the Sydney-Newcastle Motorway. Photo supplied by Rob Wheen.

Image at right: " Ray's Bridge" from above in 2019. The slight curve can be seen in this shot. Photo from Google Earth.

Image above: The Captain Cook Bridge at Taren Point, Sydney - Ray's first appointment as Engineer in Charge of Construction.
Photo: J Bar in Wikipedia.

In 1964 Ray returned to the Gladesville Bridge, this time as a qualified Civil Engineer, and was actively involved with the lifting of another of the four arch ribs from the temporary steel falsework. This was followed by his appointment as the Resident Engineer on the construction of the Captain Cook Bridge, much to the disappointment of the Gladesville RE, Sandy McKenzie, who had already identified Ray as an up-and-coming engineer and did not want to lose his talent at Gladesville.

Then, back to Bridge Design and the development of the Macarthur Bridge across the Nepean River at Camden among many others. The Macarthur Bridge was notable in that it started out with the steel girders cambered upwards (just visible in the accompanying photograph). Locals were sure that some serious mistake had been made but all became clear when, after the concrete roadway had been cast and cured the bridge was lowered to its final profile. This was a highly ingenious way of optimising the distribution of internal stresses in the bridge. Having designed the bridge it was appropriate that Ray was appointed to the role of Resident Engineer supervising its construction.

The Macarthur Bridge at Camden under construction circa 1972. Ray Wedgwood, Designer and Resident Engineer in the foreground. Photo: from Rob Wheen.

As Ray climbed the ladder of responsibility in the bridge world, family remained central to his life. He was active in his church, playing the trumpet and adding a stirring accompaniment to the hymn singing in addition to all the things that a fully active parishioner does. His three sons were married there and all of his seven grandchildren were baptised there. Notable among many things, his son Simon spoke about he and his brother Daniel being "volunteered" into helping install the cross that sits atop the bell tower of the church, by having them haul the two pieces up through the inside of the tower.

He was always actively involved in the sporting life of his sons and his grandchildren, supporting them in their involvement in cricket and soccer. He has claimed to be very adept at cutting oranges, treating a wide range of injuries with a sponge and a bucket of water, providing constructive advice to referees and linesmen and participating in full-time drinks.

These were golden years in design, construction & maintenance of bridges throughout NSW. Hundreds of bridges were being built each year. Ray's career saw him progress in DMR from design engineer, resident engineer, Supervising Engineer, Bridge Design Engineer to the pinnacle of Chief Engineer (Bridges) with responsibility for all Main Road bridges in NSW.

Ray had a passionate interest in the Sydney Harbour Bridge; in fact he designed two extra lanes to go above the existing eastern lanes, but the project did not go ahead.

# *Ray Wedgwood, NSW Bridge Engineer – 27 May 1942 to 5 March 2020*

Ray Wedgwood photographed with his Anzac Bridge in the background.
Photo: from Rob Wheen.

His major achievement, however, was the ANZAC Bridge. To provide a crossing of Blackwattle Bay in Sydney a number of alternatives were considered including a 200m span balanced cantilever design. Lurking beneath the water was a major power cable that served the City of Sydney and its location was not precisely known. The risk of damaging it or moving it during construction had consequences that were too scary to contemplate.

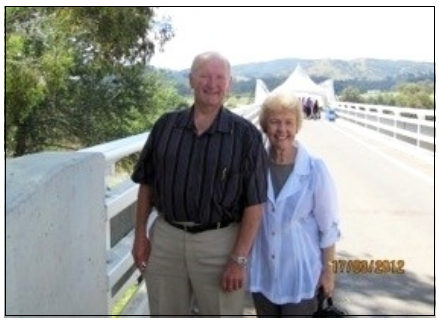
Ray took the bold decision to adopt a cable-stayed bridge with a span of 345m with the main tower supports on dry land well out of harm's way. It was a bold decision, widely criticised as an engineer's indulgence, or worse, but he held his ground. As often happens it is hard now to find a real estate agent who doesn't sell property with a view of the ANZAC Bridge as something quite special.

The Anzac bridge was opened in December 1995. If only it had been a month later in 1996. Ray was disappointed because he pointed out that the Harbour Bridge was opened in 1932, the Gladesville Bridge in 1964 and if the ANZAC Bridge had opened in 1996, that would have been a major bridge opened in Sydney every 32 years. He used to speculate on what could open in 2028. A favourite saying of his was that "roads existed simply to join up the bridges".

Officially he "retired" in 2004 but continued to keep an active interest especially in bridge history and heritage matters. Ray and Carol travelled extensively throughout Australia taking a particular interest in the history of the locations they visited and noting almost every bridge, according to Carol. On one visit out near Lake Eyre to witness an eclipse of the moon, Ray called in from a phone box in the middle of nowhere to set Macca (of the *Australia All Over* ABC programme) straight on a matter relating to the history of the Sydney Harbour Bridge. Subsequently Ray was a frequent guest on Macca's programme, becoming his go-to man on all matters relating to bridges. His radio presence was impressive and his authority unquestioned.

The Tharwa Bridge in 2017.
Source: the 'Rambling Wombat' on the internet.

Two campaigns stand out in relation to bridge heritage – one a failure, the other a success. In both cases his friend and collaborator was Brian Pearson, Ray's predecessor as Chief Engineer (Bridges) of the Department of Main Roads (later RTA). Between them they claimed more than 80 years of experience as professional bridge engineers. Together they campaigned long and hard for the retention and upgrading of the bridge crossing the Nepean River and the saving of Thompson Square in Windsor N.S.W. Their evidence before the Legislative Council Select Committee was compelling, concise and highly professional, but sadly was completely ignored by the Government.



Ray & Carol at the re-opening of the Tharwa Bridge in 2011.. In the background is the marquee erected on the bridge for the ceremony. Photo supplied by Rob Wheen.

Their engineering heritage conservation success was the Percy Allan designed timber truss bridge at Tharwa, south of Canberra. There were load limits on it and it was scheduled for demolition by the ACT Government. Again, this formidable duo campaigned for the repair and upgrading of the bridge, retaining its original appearance but with subtle but significant structural enhancement to carry the larger traffic loads. The local community were overjoyed and turned out in force at the opening and feted their hero engineers.

Ray Wedgwood leaves a legacy of many fine bridges for NSW. He is survived by Carol, sons Mark, Simon and Daniel and seven grandchildren.

*From Rob Wheen, also a bridge engineer and a friend from childhood of Ray Wedgwood.*

***A footnote from the Editor:*** Restoration (or reconstruction) of Tharwa bridge was very interesting and has been thoroughly recorded
First, a *Concise History of Tharwa Bridge* - a conference paper by Ray and Brian Pearson at
https://search.informit.com.au/documentSummary;res=IELENG;dn=880783106924328
and another at: https://search.informit.com.au/documentSummary;res=IELENG;dn=895458627684800 by Hilton & Millie.

# *MELBOURNE'S TRAMWAY SUBSTATIONS*

*By Owen Peake.*

Melbourne has a very extensive electric tram system, largely operating in the centre of public roads, and over a very long time trams and motor car drivers have learned to co-exist, although generations of car drivers grumble constantly about the "bloody trams". Mind you, to be fair, one of the really good thing about trams is that they tend to stay on their rails and not wander all over the place as some drivers do!

In the very early days trams on rails were hauled by horses. The first horse tram in Melbourne ran in 1884 (and the last in 1919). Only a year later (Nov.1985) the first cable tram service was inaugurated - trams hauled along by underground endless cables, generally powered by stationary steam engines in buildings along the route. Most of these early tram services were soon superseded by electric trams, starting in 1889 - running on rails and obtaining their electric current from overhead pick-up wires. These wires are supplied, in the present Melbourne system, at 600 Volts direct current (DC) by substations at regular intervals along the tram routes. The substations take alternating current (AC) power from the local distribution system, convert it to an appropriate AC voltage and rectify it into 600 Volt Direct Current for distribution to the overhead tramway wires. The return circuit, at earth potential, comes back via the tram rails.

Electric trams have now been in service in Melbourne for 130 years. This long period of electric trams saw all generations of substation equipment used. The earliest systems used AC motor (to) DC generator sets, before a general shift to rotary converters which convert Alternating Current to Direct Current in a single electrical rotating machine. Mercury arc rectifiers took over the AC to DC conversion in the 1920s due to their lower maintenance costs (with no moving parts) once they became available. The first solid state rectifiers appeared post-World War II. Some substations contained a mixture of equipment, with a gradual shift to all-solid-state rectifiers as power electronics matured.

In a recent inspection of seven substations with Miles Pierce, we saw a number of very interesting pieces of equipment. Several substations still had glass bulb mercury arc rectifiers in place but not in service. Several substations had large rotary converters still in place but not in service. Units of 500 and 600 kW were seen. Each generation of equipment is smaller than the previous generation so it has not been necessary to remove much of the older equipment. As a group these substations present a very impressive engineering heritage collection although unfortunately, it is largely beyond public access.

## *Brief notes on a visit to seven of the Melbourne Tramway Substations on 11 November 2019*

**1. Carlton (Queensberry Street).**
See https://vhd.heritagecouncil.vic.gov.au/places/13964

- Built 1925
- Present equipment dates from the 1980s.
- 2 x solid-state rectifiers.
- AC incoming panels are 6.6 kV plus about 10 outgoing panels.
- No Control Room currently in use in the 1925 building.

Image right: Shows the front (facing Queensberry St.) and east side (along Bouverie St.) of the building. It was designed by the M&MTB architect and built as part of the upgrade to all electric traction from 1925. At the time, its neighbour on Bouverie St was a small terrace house, replaced in 1964 with a plain brick extension to the original building containing a new Control Room (far right).. Source: Victorian Heritage Register.

**2. Brunswick Road, Brunswick.**
See https://vhd.heritagecouncil.vic.gov.au/places/2155

- Within the main room are two transformers, and a rotary converter not installed or connected. Reputedly the rotary converter was at an earlier time installed and operating at this site.

Image left: This utilitarian 1887 brick shed was originally built as a cable tram engine house, and was converted to a Tramway substation in 1936, when the cable trams along Sydney Road were replaced by electric trams. Source: Vic Heritage Register.


### 3. Essendon (Queen St).

- Essentially an empty room with three empty electrical panels in one corner.
- This site has been invaded by birds and is filthy.

Image right:: A section of the interior of the Essendon substation, showing the dirty condition of the few surviving panels. This substation is not shown in any heritage lists. Photo: Owen Peake.

### 4. Maribyrnong.

See https://vhd.heritagecouncil.vic.gov.au/places/13963

- Empty building.
- Some interesting evidence of war time camouflage. (This site is close to the Maribyrnong Ordnance Factory).

Image left: This Maribyrnong substation was built in 1942, at the height of the threat of war from the air. Built from reinforced concrete, and backing onto an abandoned quarry, its strange shapes were intended to camouflage it when it was viewed from the air. Source: Vic Heritage Register.

### 5. Brunswick West (Dawson St & Melville St).

- Very complete station, virtually exactly as it was when removed from service. See Image at right Source: EHA Register
- See the next pages for Miles Pierce's description and discussion of the engineering heritage of the contents and operation of this substation.
- Find further references at: https://portal.engineersaustralia.org.au/heritage/west-brunswick-mercury-arc-tramway-substation and https://heritagecouncil.vic.gov.au/wp-content/uploads/2019/11/ed-recommendation_include_Brunswick-West-Tramway-Substation_FINAL.pdf

### 6. Deepdene (Kitchener Street, Balwyn).

- Small station adjacent to the old Outer Circle Rail Corridor (now a "Linear Park").
- Attractively designed for its suburban location amongst houses.
- Transformers on outside plinths have gone but the interior is fully equipped.
- New tramway substation adjacent closer to the Whitehorse Road tramline.

Image left: The old, now out of service, Deepdene tramway substation inspected, with the new, red brick operating substation behind it to the left.

### 7. Malvern (at Malvern Tram Depot).

- Visited previously.
- Very complete station.
- For reference see: https://portal.engineersaustralia.org.au/heritage/malvern-tramway-substation

Image right: A general view of the interior of Malvern substation showing a switchboard (centre), two rotary converters (right background), part of a deconstructed rotary converter (left foreground), the hook of a travelling crane and some slings. Source: Heritage Victoria.

# *The Brunswick West Tramway Substation has been added to the Victorian Heritage Register*

*By Miles Pierce*

On 6 February 2020, the Heritage Council of Victoria resolved to add the Brunswick West tramway substation to the Victorian Heritage Register (VHR number H2397). This followed from a nomination prepared by this author and submitted on behalf of Engineering Heritage Victoria in July 2018. Separately, in November 2019, the same substation was recognised under the EHA heritage recognition program with an Engineering Heritage Marker.[1] The nomination in this case was prepared by Owen Peake and based on the VHR nomination.[2]

The Brunswick West Tramway Substation, viewed from the corner of Dawson Sreet (left) and Melville Road (right). Photo: Miles Pierce, 2014.

The Brunswick West tramway substation in Melbourne's inner north was commissioned by the Melbourne & Metropolitan Tramway Board (MMTB) in 1936 to power electric trams on the then newly built West Coburg line. The substation is housed in a brick building reflecting the early moderne symmetrical style[3] and is prominently positioned at the head of the curved intersection of Dawson Street and Melville Road in Brunswick West. The building contains a 600 kW Hewittic glass bulb mercury-arc rectifier assembly that was in continuous service from 1936 until February 2019 when it was retired in favour of new package substations on other sites. As such, it is the only intact glass bulb mercury-arc rectifier plant for electric traction service that has survived in its original setting in Victoria. Also, interstate enquiries made by the writer have not revealed any similar extant installations elsewhere in Australia. In a few instances, mercury-arc rectifier plant exists at volunteer run tramway museums, but these installations are not original. For this reason the Brunswick West tramway substation is particularly important and significant from a heritage perspective.

The means of obtaining a unidirectional electric current flow by means of an arc struck between a mercury pool and carbon electrodes – diode action – was first discovered in 1882. The commercial development of this discovery for the conversion of Alternating Current (AC) to Direct Current (DC), called rectification, was pioneered by Peter Cooper-Hewitt in the USA from 1900. By the late 1920s reliable industrial mercury-arc rectifiers in glass tanks were available from several makers with the earlier problems of propensity for 'back-firing' (direct conduction between adjacent anodes amounting to a short-circuit) largely overcome.[4] From this time, they started to supplant rotary converters, particularly for low to medium power demands, where they offered a higher conversion efficiency.[5] As essentially 'static plant', mercury-arc rectifier maintenance was also minimal. An alternative steel-tank version was developed for higher power applications although the early versions of these units entailed the additional complication of continuous evacuation using specialised vacuum pumping plant. By 1935 the capacity limit for glass-bulb mercury-arc rectifiers was about 500Amp, 600 Volt DC (300 kW), however higher capacities could be achieved by operating two or more bulbs in parallel. The 600 kW rated Hewittic mercury-arc rectifier installation at Brunswick West substation has four six-pole glass-bulbs, each housed in a sheet-steel cubicle.


Four cubicles, each holding a 600 kW Hewittic mercury-arc rectifier. Photo: Miles Pierce.

1 See: https://portal.engineersaustralia.org.au/heritage/west-brunswick-mercury-arc-tramway-substation

2 https://heritagecouncil.vic.gov.au/wp-content/uploads/2019/11/ed-recommendation_include_Brunswick-West-Tramway-Substation_FINAL.pdf

3 R Jones, *From rotary converters to solid-state: tramway substation architecture in Melbourne*, Melbourne Tramway Museum, 2014. http://www.hawthorntramdepot.org.au/papers/substations.htm

4 H Rissik, *Mercury-arc Current Converters*, 2nd edition, Pitman, London, 1941

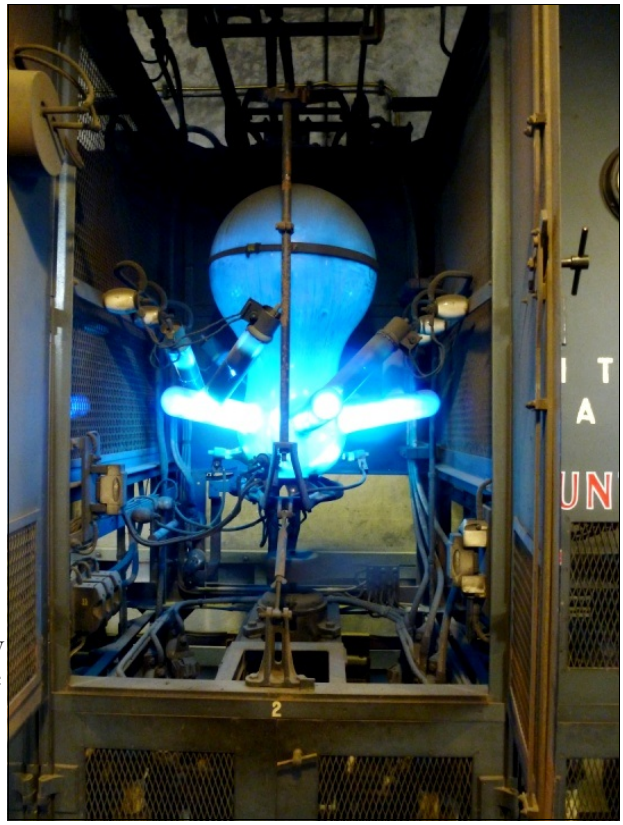
5 See article on Melbourne's remaining rotary converter substation in EHA Magazine Vol. 2 No. 1, January 2016. https://www.engineersaustralia.org.au/Communities-And-Groups/Special-Interest-Groups/Engineering-Heritage-Australia/Previous-Magazines

# *The Brunswick West Tramway Substation has been added to the Victorian Heritage Register*

As well as the glass bulb rectifiers themselves, the Brunswick West tramway traction substation contains 6.6 kV incoming AC supply switchgear housed in three tall brick cells; the rectifier transformer; a high-speed negative side DC circuit breaker; and an open panel 600 Volt DC positive side switchboard with DC circuit breakers and related control gear for the outgoing DC feeders to the tramway trolley wire. The oil-cooled 690 kVA rectifier transformer is itself visible to passers-by behind a chain-wire grille opening in the front of the building, underlining the latter's function.

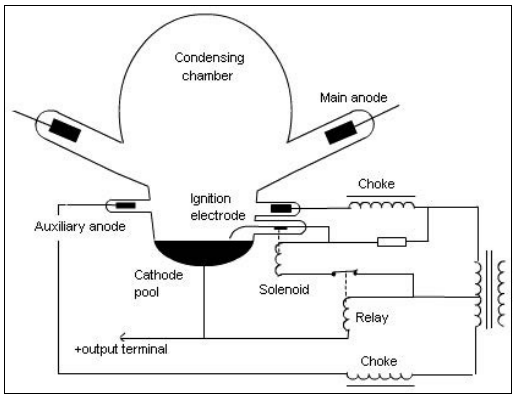
Image left: A detail from Miles Pierce's 2014 photograph of the substation, showing the rectifier transformer, which converted incoming high-voltage AC power to lower voltage AC, ready for the rectifier to convert it to 600 volt DC power for the overhead tram wires.

As can be seen from the 2014 photograph of one of the glass-bulb rectifier units in action, the hardware consists of an evacuated and sealed blown-glass bulb that contains a pool of liquid mercury in its base and a series of graphite anodes in individual cranked glass tubes welded into the lower part of the bulb. The number of anodes matches the number of phases on the rectifier transformer secondary winding, in this case six, a common configuration. On energisation, an ignition electrode draws a brief arc between it and the mercury pool. Conduction is then maintained by a pair of excitation anodes that are above and close to the mercury pool and supplied from an auxiliary winding in the main transformer. The diode action of the conduction arc from one and then the other excitation electrode as the AC supply alternates adds to the low-pressure mercury vapour within the bulb via the hot spot where the arc contacts the mercury surface.



Glass bulb mercury arc rectifier in operation at Brunswick West Tramway Substation 'W' in 2014. The eerie blue glow from the device is characteristic of this form of rectifier. Photo: Miles Pierce.

When an external DC load - electric trams in this case - is connected between the mercury pool and the neutral point of the transformer main secondary windings, unidirectional conduction then takes place cyclically at the AC supply frequency (50 Hz) between the mercury pool and each main anode in succession as it becomes the most positive. In practice, the electron migration is from the mercury pool to each successive anode, and thus the 'conventional' unidirectional current 'flow' is from the anodes to the pool, making it the positive terminal so far as the external load is concerned. As the external DC load increases, such as when the tram(s) accelerate, the more intense mercury-arc generates additional mercury vapour. It is important for the continued functioning of the rectifier that the mercury vapour pressure remains relatively low and it is the function of the large domed bulb to cool the mercury vapour as it rises, with condensed mercury on the upper parts of the bulb then draining back down to the pool by gravity. To assist this process, a large propeller type fan is positioned under the bottom of the glass bulb assembly and driven by an electric motor whose speed varies up and down in accordance with the rectifier DC load.




Simplified diagram of the components of a mercury arc rectifier, including the cathode pool of mercury at the base, undated. Source: Virtual Valve Museum, https://www.valvecollector.uk/mercuryarc.htm

In operation, it is impossible for the human eye to discern the commutation from one anode to the next at the frequency of the AC supply (50 Hz), and thus all appear to be conducting with the bulb emitting the characteristic flickering blue-green light associated with a low-pressure mercury-arc discharge whilst the hot spot dances around on the surface of the mercury pool. The greater the external DC load, the brighter is the visual display. This phenomenon makes the glass bulb mercury-arc rectifier an unusual piece of electric power apparatus, in that something can be seen to be happening that otherwise is limited largely to the rotating shaft of an electric motor. In normal service, the glass bulbs are inside their individual sheet steel cubicles with the doors closed, and their flickering blue-green light is only indirectly visible through the ventilation openings.

# *The Brunswick West Tramway Substation has been added to the Victorian Heritage Register*

In December 1984, the extensive Melbourne electric tramway network had some 28 traction supply substations of which 9 used rotary converters, 12 had mercury-arc rectifiers and a further 7 newer installations were fitted with solid-state silicon diode rectifier assemblies that from the 1960s superseded both of the previous forms of AC to DC conversion.[6] With the final retirement of the Brunswick West substation in early 2019, all in-service Melbourne tramway substations are now based on solid-state rectifier plant. Two sets of four glass bulb mercury-arc rectifiers along with some associated switchgear remain at the former Deepdene tramway substation in Melbourne's eastern suburbs, but the installation is now far from complete. Some remnants of rectifier cubicles minus their original glass bulb rectifiers and most other related plant also languish in now out of service tramway substation buildings in a few other suburbs. The installation at Brunswick West is the only glass bulb mercury-arc rectifier to have survived essentially intact and as it was when retired from active service.


The 600 kW rated, Hewittic brand, mercury-arc rectifier bank has four, six-pole glass-bulbs each rated at 150 kW. Each bulb is housed in a dark grey painted, perforated sheet-steel cubicle, each with a propeller type metal cooling fan whose operating speed varies with the rectifier load current. This image (and caption), from Heritage Victoria, is of one of the cubicles with open doors, to show the rectifier and the fan.

At this stage, the Brunswick West substation is not available for public inspection and any internal visits have currently to be arranged with the tram operating company Yarra Trams, which leases the traction substations, along with the tracks, trams, etc., from VicTrack, the government owners. As inspections require the involvement of tramway operations personnel, arrangements to visit the substation and see inside are not readily sanctioned. In the longer term, it is hoped that, provided the building and its internal plant and equipment are preserved, ways will be able to be found to make the installation more readily accessible, if only by prior arrangement for 'special interest' groups.

Being able to observe the mercury-arc rectifiers in operation is less likely as it would require the 6.6 kV AC electricity supply feeder to remain available and also some electrical load on the DC side. At this juncture, the Engineering Heritage Marker (EHM) is a 'virtual marker'. Arrangements to install and formally unveil a physical Engineering Heritage Marker and an associated interpretation panel may take place at a future date.

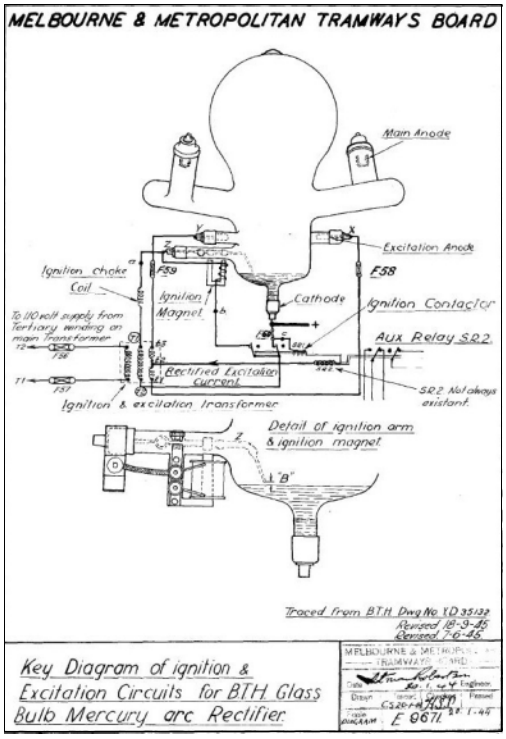



Image Left: 1945 diagram from the Melbourne & Metropolitan Tramways Board showing how a mercury arc rectifier is ignited.
Source: Public Transport Victoria.

Image Right: An aerial view of the Hewittic Rectifiers factory in the UK in 1934. It appears to have been built in the back garden of a riverside mansion on the Thames. Source: Grace's Guide.

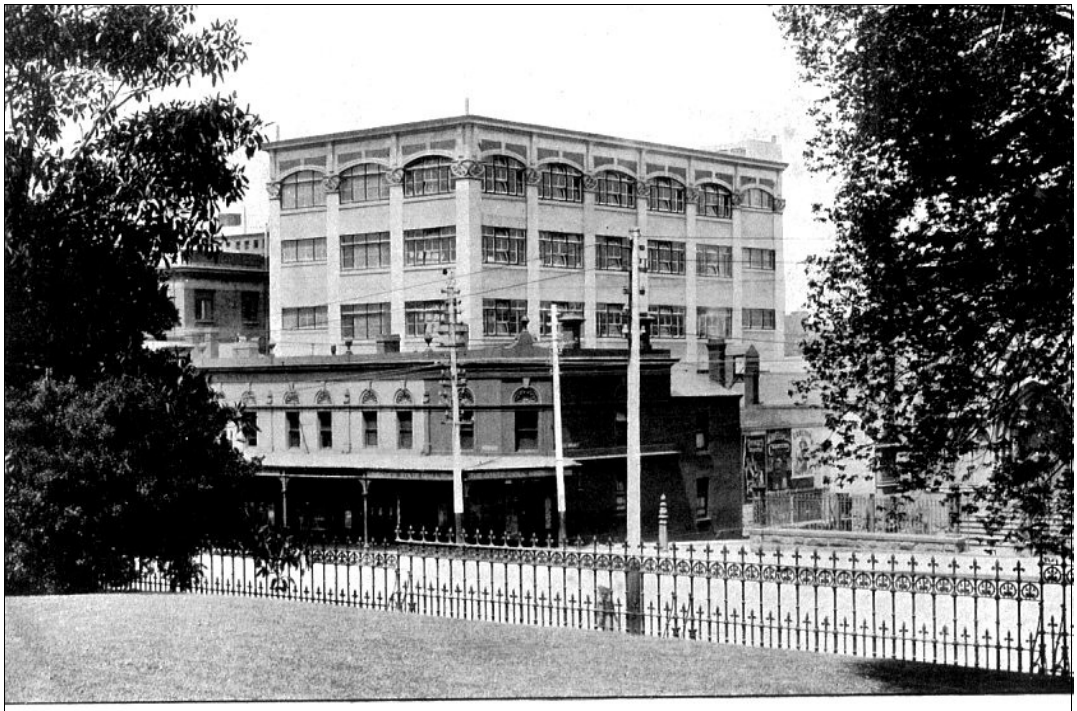
Side view of the Brunswick West rectifier transformer at the front door of the substation.
Photo: Miles Pierce


6 G Vines, *Melbourne Metropolitan Tramway Heritage Study* a Report for Heritage Victoria from Biosis Research, Melbourne, 2011. (See Figure 124, page 155, attributed to Robert Green).

# *The former Sniders & Abrahams Building,*

## *built in 1909 as a cigarette factory at 7 Drewery Lane Melbourne.*

*By David Beauchamp*



SNIDERS & ABRAHAMS PROP. LTD.—FACTORY, MELBOURNE.
View from Public Library.

This image (above) shows the building as it was built, with five floors, before two floors were added in 1938. The view is from the grounds of the State Library looking diagonally across the intersection of Swanston Street (beyond the picket fence) and Little Lonsdale Street. The Sniders & Abrahams building is partly concealed behind a low building on the corner. This and the following three early B&W photos are sourced from the H.R.Crawford files.

The former Sniders & Abrahams building at 7 Drewery Lane, Melbourne has been awarded national engineering heritage status by Engineering Heritage Australia. An Engineering Heritage Marker will be placed on the building this year to mark its national heritage significance.

The building is now known as the Dovers Building, and it goes under this name on the Victorian Heritage Register.[1]

Dovers Building was re-named after the printing works that later owned it. In recent years it has been converted to an apartment building.

The 109 year old Sniders & Abrahams factory is the third oldest existing building in the world utilizing the Turner Mushroom System of flat-slab design.

It was the first wholly reinforced concrete building erected in Melbourne and the first in Australia to use a flat-slab form of construction.

Hugh Ralston Crawford, the engineer/architect who designed & constructed the Sniders & Abrahams factory was the first person to significantly challenge the Monash/Monier monopoly on the use of reinforced concrete in Melbourne. He held the Australasian rights for the use of the Turner Mushroom System and went on to use this form for a significant number of other buildings, many of which are still in use today.


SNIDERS & ABRAHAMS PROP. LTD.—FACTORY, MELBOURNE
Typical Floor Reinforcement.

1 See https://vhd.heritagecouncil.vic.gov.au/places/744/download-report

In 1938, when the building had been acquired by Godfrey Phillips Australia Pty Ltd, Crawford was engaged to design an additional two floors to the building and these were subsequently built, again using the Turner Mushroom System. Today the building is an apartment block with a penthouse added and the ground floor altered to accommodate two floors of car parking.

The Turner Mushroom System is named because of the shape of the shear reinforcement radiating from the columns as shallow truncated cones. The remaining slab reinforcing is placed both diagonally and orthogonally between the columns, giving four belts of reinforcement as can be seen in the photo of a slab ready for the concrete pour (see previous page).[2]

Hugh Ralston Crawford was born in the United States in 1874 and when he was 9 years old his family moved to Townsville. In 1890, at the age of 16, he was articled to the Townsville civil engineers and architects, Eyre and Munro. After six years he joined the Bridge Department of the Queensland Railways and was later in charge of railway construction. He was heavily involved in the construction of the 1905 concrete arch bridge over Deep Creek at Chowey in S.E. Queensland.

In 1906 Crawford moved to Melbourne and set up in private practice as an engineer and architect. In the same year Claude Allen Porter (C.A.P.) Turner of Minnesota U.S.A. applied for an Australian patent for his Mushroom System of flat-slab construction. Crawford, shortly after, became his Australian representative and in 1909 adopted the system for the design and construction of a factory at 7 Drewery Lane built to accommodate 900 women to hand make cigarettes for the Sniders & Abrahams firm of cigar & cigarette manufacturers .


SNIDERS & ABRAHAMS PROP. LTD.—FACTORY, MELBOURNE.
Test Load on Second Floor:—Loaded 16 ft. square (weight of workmen not included).
Columns, 18 ft. 6 in., centre to centre.

Construction started in 1908 with Hugh Crawford's father, Duncan, as the Foreman Constructor. The concrete was mechanically mixed on site and hoisted by electric lift to each floor. Each floor slab, apart from the roof, was poured without a break, taking an average of 38 hours. The hoist broke down when the roof slab was being poured and work had to stop until the next morning when the hoist had been repaired.

After the building was completed, part of the second-floor slab was load tested to prove its adequacy, as the building code of the day did not cover reinforced concrete construction, let alone flat slab construction. It was not until 1917 that the Turner Mushroom System was recognised by building codes in Australia.

In the photo (above) Hugh Ralston Crawford is the man at left wearing a white hat, while his father, Duncan Crawford, the Foreman Constructor, is the bearded figure to the right of the sign.

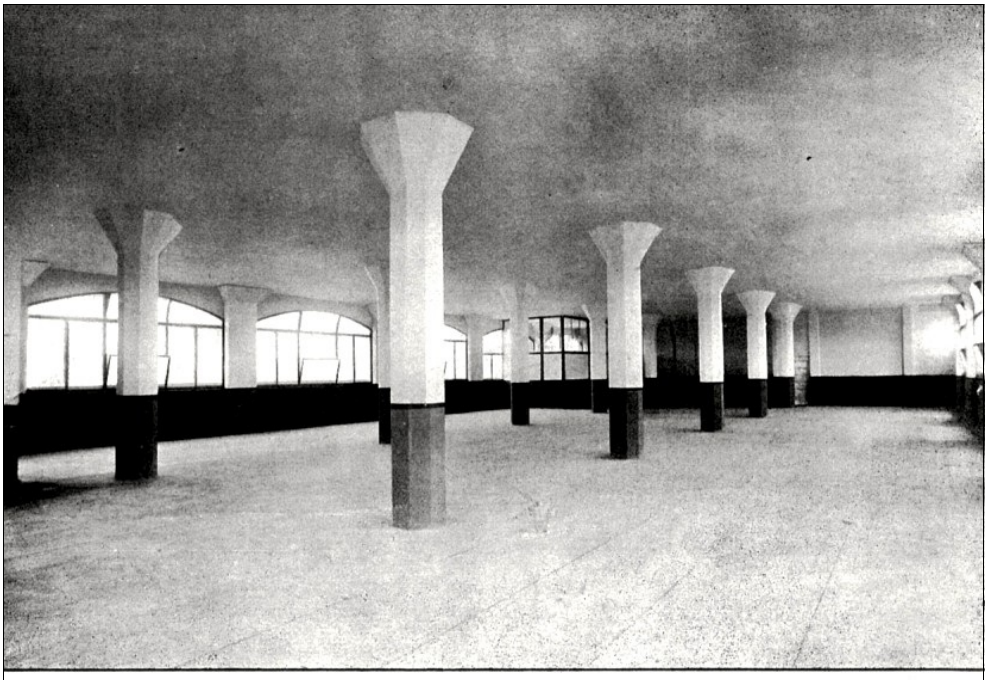
After the Sniders & Abrahams factory, Crawford, using the Turner Mushroom System, designed a bond store for the same firm. Between 1911 and 1914 he used the same system for the design of at least two other factories. He also designed several concrete houses using a system of reinforced walls to span between concrete piers.

2 A search for comparisons in early development of concrete flat slabs turns up a number of references. Accessible (and free to download), is *The mushroom column – Origins, concepts and differences*, by Mario Rilke & Andreas Thuy, from *6th International Congress on Construction History 2018*, at Brussels. See: https://www.researchgate.net/publication/335542621_The_mushroom_column_-_Origins_concepts_and_differences
For another see https://pdfs.semanticscholar.org/53ae/a3c06fe112be03a722644b97137093a29faa.pdf – *Early Mushroom Slab Construction in Switzerland, Russia and the U.S.A. – A Study in Parallel Technological Development* by Alexander Kierdorf.

## *The former Sniders & Abrahams Building*

During the First World War Crawford became the Australian representative for the Montreal company John Metcalfe Pty Ltd, who were in Australia to report to the Federal and State Governments on the bulk handling of wheat using their system of reinforced concrete silos and grain elevators. They subsequently tendered for this work and built silos in Victoria and NSW.

After 1919 Crawford returned to private practice and was also appointed Consulting Engineer for Concrete for the Commonwealth Department of Works. He continued to use the Turner Mushroom System for the design of Commonwealth Banks, automatic telephone exchanges, a Myers warehouse and Emporium, St Vincent's Hospital in Melbourne, and other buildings.



SNIDERS & ABRAHAMS PROP. LTD.—FACTORY, MELBOURNE
Fifth Floor. All floors similar.

While John Monash's role in the introduction and promotion of reinforced concrete construction is well known, little has been said about H.R. Crawford's challenge to the Monash/Monier monopoly of reinforced concrete construction. Hopefully the awarding of a National Engineering Heritage Marker for the Sniders & Abrahams building, where Crawford first used the Turner Mushroom System for its construction, will go some way to remedying this.

---

## *Addendum to the story of 7 Drewery Lane, now known as Dovers Building.*

*From the Editor*

I thought it would be interesting to the reader to have a recent picture of the former tobacco factory, with its added balconies and extra floors above the original roof. Seldom does a utilitarian factory undergo such a satisfactory conversion to an apartment building – all while keeping so much of the original structural elements and the period decoration. According to a Melbourne rating website, the 47 (or 45) apartments are in a very desirable location (4-star), with 4-star Management, 4-star Pet Friendly, and the 5-star Built Quality is exceptional – rarely seen! Recent sales were $880,000 for two bedrooms and $1,335,000 for three bedrooms. So much for the idea that careful and sympathetic conversion and heritage listing can degrade the real estate value of a building.

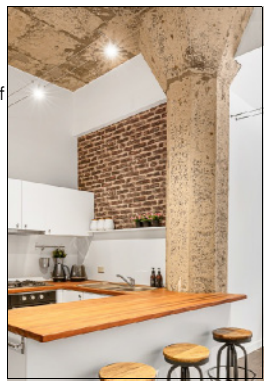


Image right:
Careful conservation and use of original structural elements (column and underside of floor slab) as part of the decor in an apartment kitchen. The exposed brickwork may have been part of an original factory layout.
Photo: Domain, March 2020.

Image left:
A recent photo of Dovers Building, showing added balconies and the extra floor levels (a penthouse at the top) added above the original decorative parapet. The "Front Door" opens onto Drewery Place. The Car Park entrance is around the far right corner of the building in Drewery Alley.
Photo: Domain, August 2018.

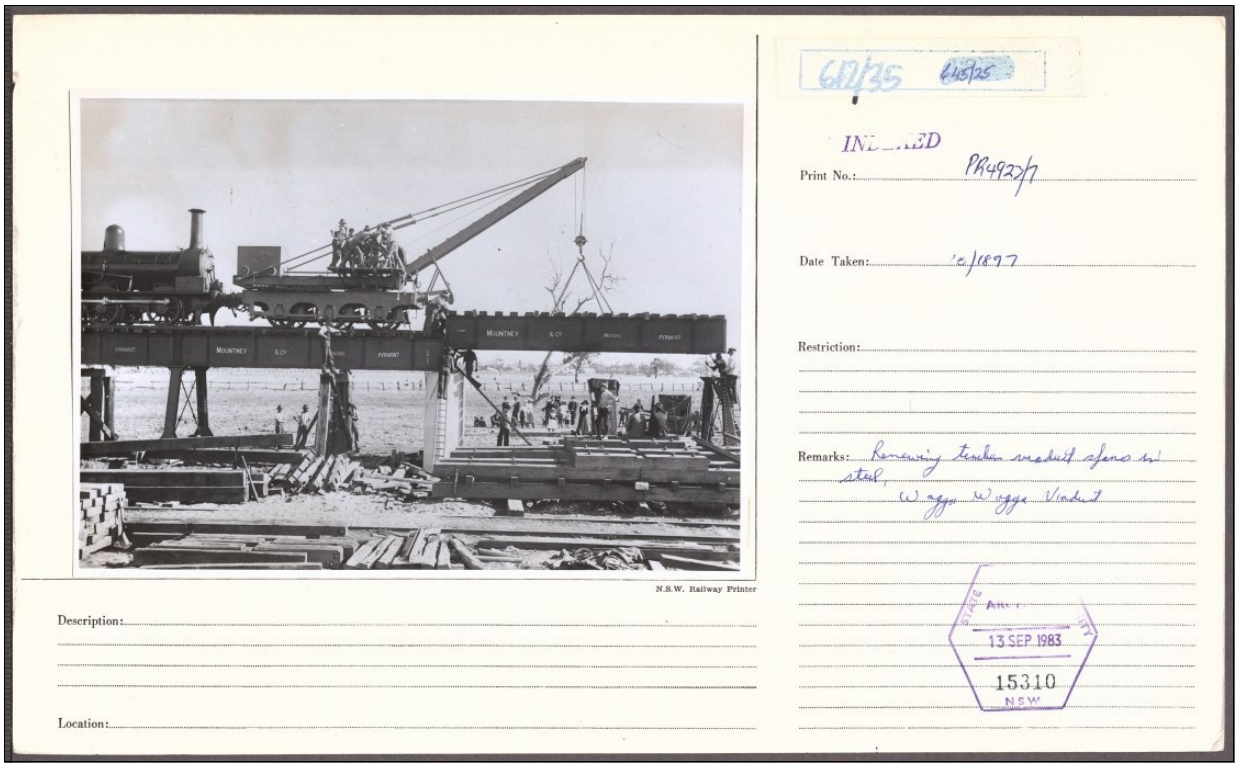
# *Making Photo Archives Accessible*

***By Bill Phippen***

The New South Wales Railways Archives origins are lost in history. Certainly, civil engineer and historian Bob Wylie played a role and Cyril Singleton, also a civil engineer, contributed greatly. Singleton is usually cited as founder of the Australian Railway Historical Society (ARHSnsw) in Sydney, from where divisions in other states were inspired. In 1959 John Forsyth, a fitter by trade, was appointed as Railway Archivist and over the next decades collected, researched and wrote the foundation documents for railway heritage in NSW. With John's eventual retirement and the general direction of government agencies to divest themselves of non-core aspects of their business, the Railway Archives were passed to the NSW State Archives & Records Authority (SARA), which holds vast amounts of records from the state government and its agencies. Much of what is written about NSW railways is based on this archive and it would seem from this author's personal experience that a disproportionate number of users of the SARA Reading Room at Kingswood in western Sydney are rail researchers.

In writing the recently published books *The Hawkesbury River Railway Bridges* and *By Muscle of Man and Horse, building the railway under Sydney 1916 - 1932*, I relied heavily on the Railway Archives and SARA. The recent restoration of the First World War Honour Board at Central station in Sydney and the biographies of the 1219 men whose names it holds, all railway or tramway men dead on active service, delved deep into nearly 200 boxes of personal history cards at SARA.

One of the most used, perhaps overused, series in the collection is NRS17420, State Rail Authority Reference Photo Collection. This is really John Forsyth's work again. It comprises 52 large file boxes of photos pasted on large cards.




A typical file card from the NRS17420 Collection, with a stuck on photo print and some brief identification details. Bill Phippen says, about this card: This is about as much information as you ever get and a lot more than most. Remarks on it are: "Renewing timber viaduct spans in steel. Wagga Wagga Viaduct". The date of the photo is October 1897. Source: ARHS NRS17420_2_645_025_002

The present project which is the focus of this article has revealed the number of images to be 32,409. To maximise access to this collection, and to allow it to be soon "locked away" before further frequent handling degrades it, the Australian Railway Historical Society NSW Division, through its archives wing, the Railway Resource Centre (RRC), made the bold offer to scan the whole collection. The RRC is well versed in scanning and cataloguing images as its own collection is about 850,000 images, all but the most recent acquisitions are scanned and 531,945 are on the searchable database.

SARA responded to the offer enthusiastically. ARHSnsw offered to supply the scanner, provided it could be left at Kingswood for the duration of the project, but SARA decided that it would supply the scanner and a dedicated room, off the main Reading Room, for the virtual exclusive use of the project. A team of ARHSnsw volunteers, led by life member and EA fellow, Bill Phippen (myself) with Bernie LeBreton and Allan Smith, was assembled and the project operates Tuesday to Saturday. (SARA is not open on Mondays). Allan and Bernie are both retired tradesman fitters and very good at getting a job done – even if the tool is an Epson scanner. The standards applied are high. The card is scanned to secure the data written on it and the one or more photos it contains are scanned as archival standard TIF files. A typical day produces about 80 scanned photos.

## *Making Photo Archives Accessible*

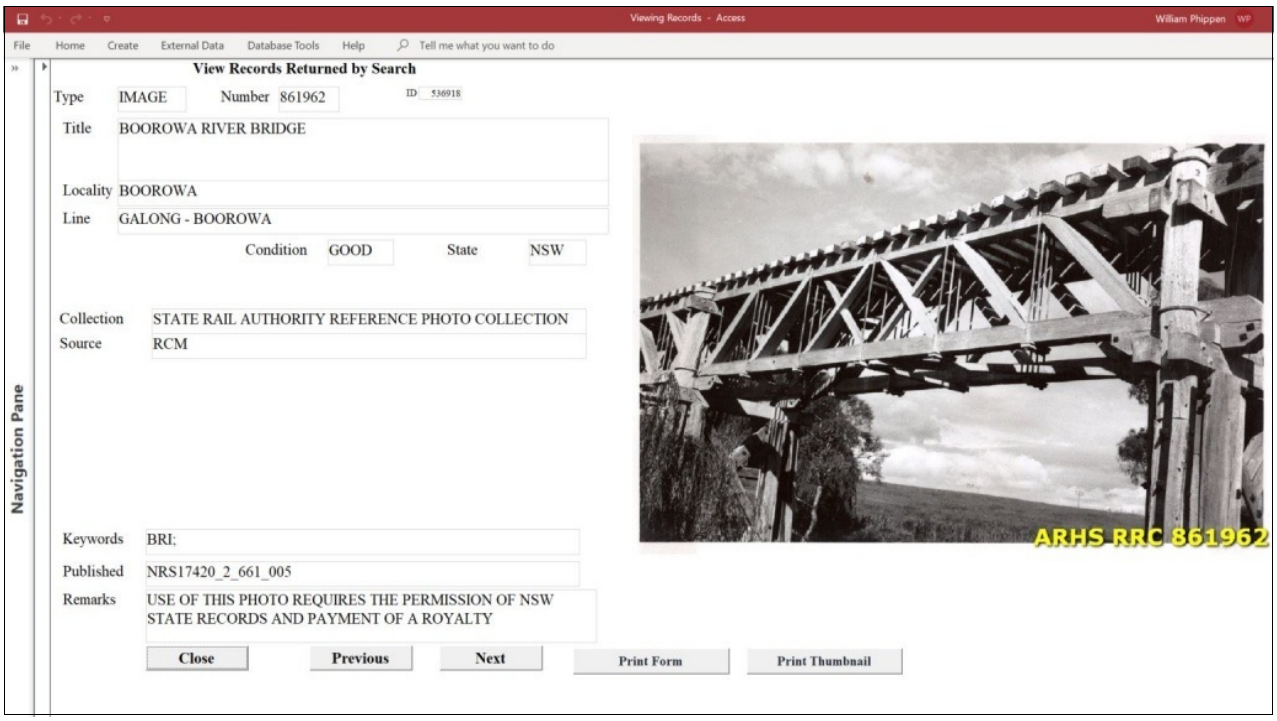
Work commenced in May 2019 and is expected to continue into 2021. Ultimately the photos will be available for perusal on the SARA website and purchase in the usual way. As a first phase of the task all of the cards were transcribed, and that is how the total number of images they contain is known. This data has been entered into the ARHSnsw database, so that while at present only just more than 13,000 photos are fully incorporated, all 32,000 are searchable, of course without an image until the scanning includes them. The photos will be available for purchase from ARHSnsw by arrangement with SARA.

The project would always welcome extra hands, and there are other series in the collection which could be digitised. SARA is located in far western Sydney, at 161 O'Connell Street, Kingswood, near Penrith.

---

## *A note from the Editor*

The work on this project of Bill, Bernie and Allan came to an abrupt halt not long after he sent me his story in early March this year. The Railway Resource Centre was closed to volunteers and the public, and the State Archives Reading Room was closed also, both due to the Covid -19 lockdown in NSW. No more scanning for the time being for Bill and his colleagues. But of course the websites of both organisations can still be searched, and they are open to enquiries via email.




Screen shot of a typical transcribed file card and image as it appears on screen after a search of the ARHSnsw database. Source: Bill Phippen.

After he sent me the photo archives story, I had many questions for Bill, mostly relating to his system of cataloguing and how one would search for particular subjects and what one could discover. He sent me a rather comprehensive account of how they did the cataloguing (rather too long to reproduce here), and an illustration (literally – the image above) of what one could discover in a search of the ARHSnsw catalogue. Here is what Bill wrote about that:

> "The image I have attached is of a search I have made and shows the data and thumbnail as it is presented on screen. The Title is what it is a picture of. The locality is Boorowa on the Galong to Boorowa Line in NSW. It comes from the SRA reference photo collection; its original railway print number was 'RCM'; the only thing in the picture is a bridge; its NRS number is given and a note that ARHSnsw has an agreement with SARA to pay them a fee if we onsell. Note that we do not launch into a complete description of the bridge - when it was built, its span, what sort of truss it is etc. We locate pictures, not write theses on each one.
> These SARA pictures are part of the full ARHSnsw collection which at the moment has 532,943 images fully searchable, with about another 300,000 in the pipeline.

My original request (in March) for a discussion of the photo archives was prompted by a story Bill sent me late last year, about some puzzling photos he found in the collection in the process of scanning and cataloguing. I hope that story, *The Mysterious Bradfield Pictures* will appear in the next issue of the Magazine. After this discussion of the photo archives, you will find another narrative, inspired by Bill's and his colleagues' discoveries in the SARA collection. This extraordinary sequence of photographs comes from an album, which tells the story of *The Emergency Reconstruction of the St Helena Washaway.*

# *Emergency Reconstruction of the St Helena Embankment*

*By Bill Phippen*


It had been raining heavily and continuously for several days in mid-February 1953 on the far north coast of New South Wales. At about 3.00 am on the morning of the 21st, a hillside near the small town of St Helena, above the branch railway from Casino to Murwillumbah, weakened by the rain, collapsed and ran down a small valley and into an already supersaturated embankment supporting the railway. The area was known to be unstable and the talus slope above the railway, along which ran a main road, was buttressed with heavy timber piles and a concrete apron, but they were not enough.

Viewed from the road above, the obliterated railway embankment and the extent of the mud flow beyond are clear. By this time, later on the day of the event, or the next day, workmen are already on-site starting repairs. The view here is from the west, looking toward the sea. – Murwillumbah to the left, Casino to the right. SARA NRS 17420_2_1684_140A

Three thousand cubic yards of moving mud hit the railway embankment, liquified it and the whole mass flowed away down the gully, for up to 30 chains (600 m).

By chance a ¾-mile sign post (a length of rail topped with a shaped steel plate) stood on the embankment. It was carried with the mud and later found 10 chains (200 m) away. 120 feet (36m) of rail and sleepers was left as a weird suspension bridge 30 feet (9m) in the air, by the disappearance of 3,500 cubic yards (2,700m³) of embankment.

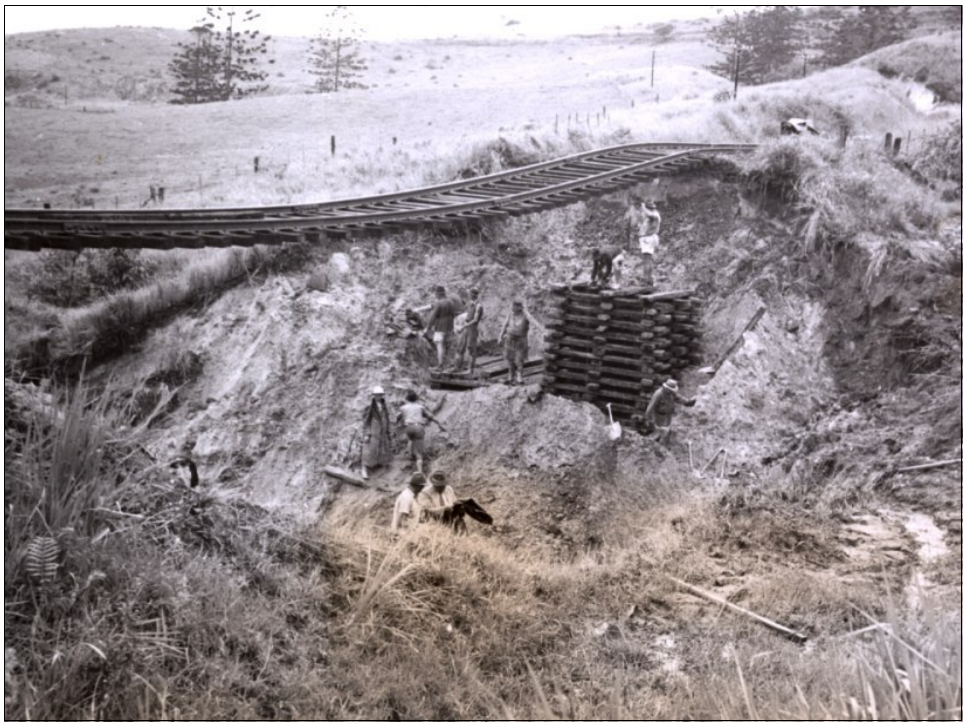
An early stage in the repair with the track still suspended over the missing embankment, Despite the previous wet spell the weather seems to have cleared to allow work to proceed in bright and dry conditions. SARA NRS 17420_2_1684_140H

The original source of the landslip. The road may have avoided damage, but its future stability is precarious. SARA NRS 17420_2_1684_140B

The heavy steel plate of the rail mile post found 200 metres from its original site.
SARA NRS 17420_2_1684_140E

Serious as the landslip was, a deadly catastrophe was avoided by the failure of the electric staff system an hour before the washaway. The safe-working system, which ensures that only a single train can travel on a section, relied on electric circuits and the heavy rain had mercifully put them out of action. Without the staff failure, it is probable that a train could have proceeded and crashed into the gap.

The rain seems to have ceased soon after the slip occurred as all the photographs of the repair show no hindrance to the work by bad weather or mud. The damaged formation was quickly discovered showing the line to be clearly cut with little chance of an emergency deviation being possible.

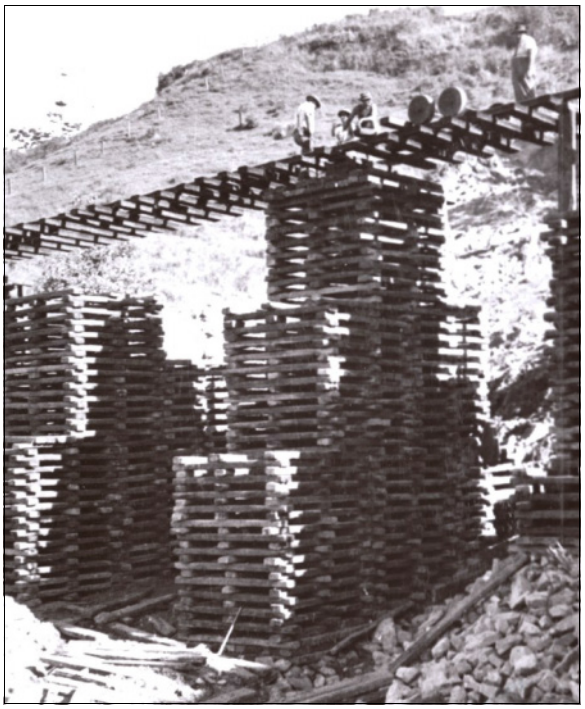


The tower of sleepers at the Casino end under construction. A considerable amount of earth had to be moved by men with shovels to form a flat base. SARA NRS 17420_2_1684_140G

At the Casino end of the work the soil was seen as too soft, so spalls were dumped as a base for the tower. In the foreground the workers hold sleeper tongs, demonstrating the method by which the many heavy sleepers were manhandled into position.
SARA NRS 17420_2_1684_140I

The embankment would have to be repaired as soon as possible. In 1953 the way to bring in several thousand tonnes of earth to build a new embankment was rail, so the line needed to be open to transport material for its own reconstruction.

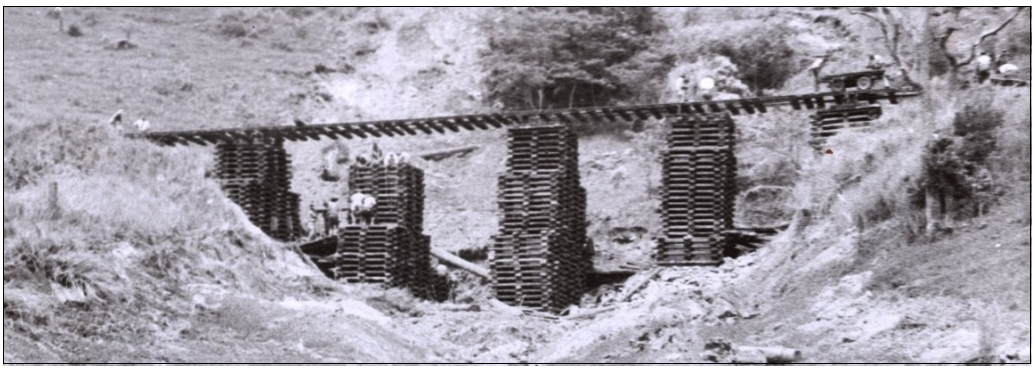
The solution chosen was the so-called timber 'pigsty' formed of towers of railway sleepers laid criss-cross.



The double-stepped design of the pigsty is necessary for stability and by this stage the track has been lifted to its true level. Since the whole repair only took six days and some time must have been spent finding and delivering the sleepers, the work shown here must have been done in only two or three days.
SARA NRS 17420_2_1684_140K

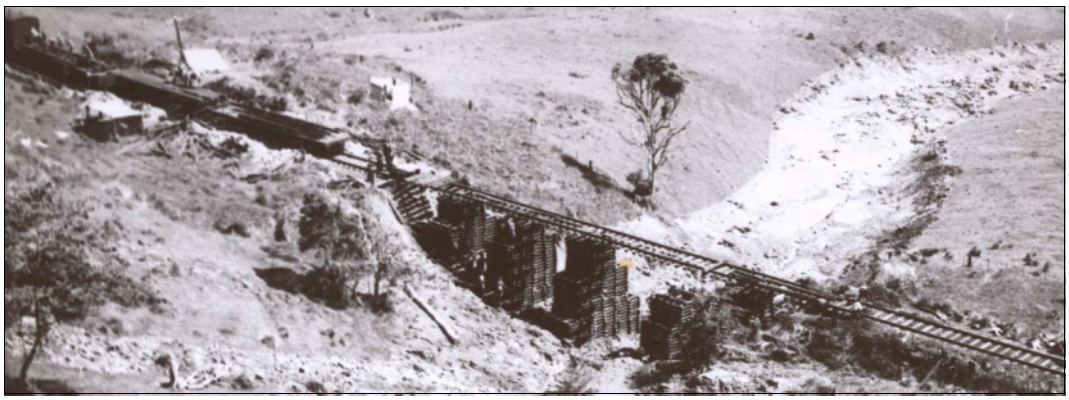
Plainly, with the height required, a simple one-sleeper-square tower would be too flexible, so a wide-at-the-base tapering design was made.

All available track workers were brought to the site, from as far away as Glenreagh on the North Coast Line, and 3,000 sleepers were rushed, presumably from stockpiles in every station yard for miles around, as far south as Coffs Harbour.



The towers are nearly complete but the heavy bridge timbers to span between them have not yet been placed. This view of the track is from downhill (east) to uphill (west). SARA NRS17420_2_1684_140JB

Sleepers are designed to support rails on a ballast formation and are not manufactured to 'Lego-like' precision to build high towers so most had to be adzed flat and of even thickness to provide a base for the next layer. Atop the sleeper pigsties large timber beams, probably about 12 inch by 12 inch (300mm x 300mm), spanned the gaps between the towers and supported the sleepers under the rail track.



A train delivers the bridge beams to the northern end of the work. SARA NRS 17420_2_1684_140JA

There appears to have been only basic mechanical devices provided to handle the sleepers or the bridge beams. Before the towers could be built a firm foundation needed to be established.

At the Murwillumbah end (left) a considerable amount of earth had to be shovelled away to provide a flat base, while at the Sydney end spalls (large dimension broken rock) were unloaded to provide a foundation for the sleeper towers in the softer soil. Despite the magnitude of the task and the large number of sleepers and the individual attention that the placement of each one required, the work proceeded quickly such that the line was re-opened at 12:30 pm on 27 February, little more than six days after the washaway.

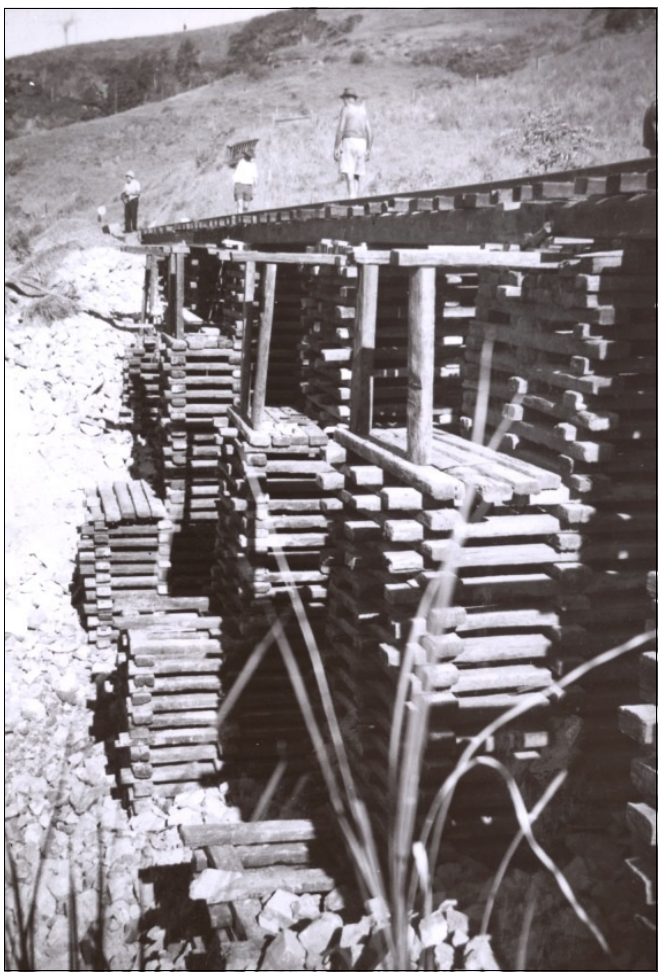


Image left: The vertical posts and single horizontal sleepers were provided to assist in positioning the heavy 12" x 12" bridge beams which would have been wheeled out and lowered over the side before being slid under the track, all by muscle power. SARA NRS 17420_2_1684_140K

Image below: The first train across what had once been an earth embankment but was now a timber bridge of sorts. In the foreground are wheels used to move the heavy bridge beams forward. SARA NRS 17420_2_1684_140T

Once the railway was re-opened the task of rebuilding the embankment was straightforward using bottom dump wagons to tip sand through the track and the sleeper towers. SARA NRS17420_2_1684_140P

However, the timber sleeper bridge was only an expedient employed for its speed of construction. The real repair would entail the replacement of the embankment and this was achieved by the carriage of 5,700 tons of sand from Byron Bay, only seven kilometres distant, dumping it from bottom-discharge wagons through the track to bury the timber structure.

There had been a concrete culvert though the embankment, but it appears to have been blocked by an earlier landslide. It was eventually cleared but in the interim water was given safe passage through the growing embankment using a timber drain filled with spalls.

The sand embankment was protected from erosion by covering the sand with a layer of coal ash, a readily available and often used by-product material generated by the operation of steam locomotives. The ash would set to some extent and better support the growth of grass than pure beach sand.

The railway from Casino to Murwillumbah continued to operate for fifty years carrying substantial trains and mainline diesel locomotives across the rebuilt embankment, until rationalisation of services led to the rail line's closure in 2004.

Provision for water flow through the new embankment is provided by a rock filled timber box drain (see at left of the gulley base). It was expected to ultimately rot and collapse. SARA NRS17420_2_1684_140Q

Deep in the gulley, a substantial concrete culvert had been deeply buried by the landslide. The task of digging it out seems to have been left until the line was repaired and the embankment re-created. The re-exposed concrete culvert is seen at lower right in the photo. SARA NES17420_2_1684_140RB

This account is derived from an album of well-captioned photographs of the work, now part of the State Rail Authority Reference Photo Collection held at NSW State Archives and Records, Kingswood, as NRS17420_2_1684_140.

Two images of the album appear on the back cover page of this issue – the album cover and a sample page of photos (see next page).

The caption for the back cover page is:

The album as it survives in the SRA Reference Photo Collection. The bindings have been dismantled for scanning.
SARA NRS 17420_2_1684_140_002

624.16.
1

1684/40

INDEXED

Book Seven

ST. HELENA LANDSLIDE.

Photographic record of slip and rebuilding of embankment at 545m.60c. North Coast. 21-2-53.

Trestle Details

General View of the high pigstys. Nearly every sleeper had to be adzed square to provide a base for the next layer.

(17)

Trestle Details

The short posts and horizontal sleepers were used to facilitate placing the girders in position.

(18)