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Cover Images: The Old and the New.

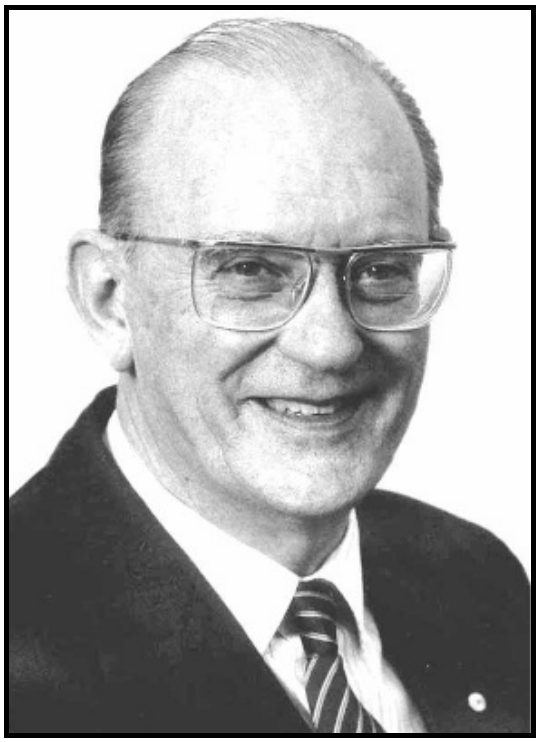
Front – Pantheon, Rome, David Beauchamp.
Back – Falkirk Wheel, Scotland, Keith Baker.

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

CONTENTS

Vale Brian Lloyd – Distinguished Engineer & Historian

Dr Brian Edmund Lloyd, AM, HonFIEAust.
Engineer and Historian,
30th June 1929 – 2nd March 2014



(Image courtesy of Engineers Australia)

Brian Lloyd was born in Hawthorn, but spent his early primary school years (and the years of the Great Depression) at Ten Mile, a remote gold-mining village on the Mansfield – Woods Point Road about ten miles south of Jamieson in North-east Victoria. Brian's father Ben Lloyd was a local mine manager and Brian and his brother Kelvin attended the tiny (10 pupil) Ten Mile State School, where the time of the sole teacher was shared with another State School down the road. The boys spent their free days "*roaming the bush [and visiting] their father at the mines*", which must have been as rich an education as they found in school.

This adventurous period of the boys' childhood ended with the terrible bush fires of Black Friday in January 1939, which burnt their home and most of the settlements and mine infrastructure in the region. The family moved to Geelong, where Brian went to St Joseph's College. His engineering education at Gordon Institute of Technology was combined with employment at Ford's Geelong Factory. He graduated with a Diploma of Electrical and Mechanical Engineering and went to work for the Tasmanian Hydro-Electric Commission, and later returned to Victoria to work for the Melbourne & Metropolitan Board of Works (MMBW) for many years until he "retired" in 1984 as the Manager of Scientific and Technical Services.

His education didn't stop in Geelong. In later years he gained a Diploma of Business Administration, a Master of Arts and a Doctor of Philosophy from Melbourne University. He didn't actually retire either. In 1984 he formed the EPM Consulting Group with some colleagues, and at some time set up a publishing firm, Histec, to publish his own books about engineering and gold mining and local history and help others get their books published. In 1995 he became an Adjunct Professor at Deakin University (the successor to the Gordon Institute of Technology) and "*over the next seven years made leading contributions to the introduction and conduct of degree programs for mature age people."* Lloyd's involvement with and influence on engineering education started with the publication by the Association of Professional Engineers Australia (APEA) of his *The Education of Professional Engineers in Australia* in the 1960s, and continued in the 1970s and 1980s with his appointment to various state and national boards and committees dealing with TAFE courses and engineer accreditation and the publication of more books about engineering education and the engineering profession.

Brian Lloyd was member (or fellow) of Engineers Australia for most of his professional career – a membership which contained landmarks such as his first election to Council in 1973, President of the Victoria Division of EA in 1981, National President in 1994 and Honorary Fellow in 1998. He joined APEA in 1955. His work as an APEA member was incredibly important to the future of all employee (ie. not principals or employers) professional engineers – even to this day. It is not widely understood any longer, but until the 1960s, professional engineer employees were classified by the State and Commonwealth government departments as clerks and thus paid at the same rates as the vast majority of non-graduate public servants. Other professionals (eg. doctors and lawyers) of equivalent standing and experience, were paid 40% or 50% more for their work. "*From 1959, with a colleague Bill Wilkin, [Lloyd] prepared vital evidence for the landmark Professional Engineers Case, which delivered significant salary increases (more than 40 per cent) for engineers and established the first national industrial award for professional engineers.*" The benefits flowed on to employee engineers throughout Australia, in industry and local government and consulting practices as well as the public service.

"Brian married his teenage sweetheart Elizabeth (Beth) Ince, who was chief dietitian at Geelong Hospital, in 1952. The loving marriage of 48 years ended in her death in 2000 - the loss assuaged by the continuing closeness of their children Brendan, Christopher, Martin and Rosemary and 10 grandchildren." [1]

1 This, and the other quotes in italics are taken directly from Rosemary Lloyd's obituary for her father, published in *The Age* on 7th May 2014.

Vale Brian Lloyd

Some Memories of His Contribution to Engineering Heritage – from Ken McInnes.

I remember Brian Lloyd from the 1970s when we were both with the MMBW, and his support on Victorian Division Committee of Engineers Australia in the late 70s when an *"Engineering Relics Committee"* was established in Victoria. In 1981, Brian followed Don Little as the Victoria Division chair and continued to support Division's Engineering Heritage activities, often attending presentations and tours.

In April 1994, in conjunction with the IEAust National Conference in Melbourne, an unveiling ceremony of the 'Historic Engineering Marker' for the Spotswood Pumping Station at the Museum of Victoria was arranged. The opening was by the Engineers Australia president for 1994, Brian Lloyd, who gave a memorable off-the-cuff speech about the regimented, sometimes oppressive, social conditions at the pumping station – kind of akin to the hierarchy of maritime engineers working on a ship. The rest of us were celebrating the technical, engineering and social significance of the pumping station, but Brian was drawing us back to the working and social conditions during its operation.

Brian wrote and delivered many papers on the engineering profession and sometimes drew on his general knowledge, such as in the paper *"Lessons from History: The Great Engineering Eras"* that he gave to the International Conference on Engineering Management in 1994. Brian was always one to bring the human and family story into engineering endeavours. Over many years he traced the family of J.T.Noble Anderson, so he could add the family layer into his paper *"Joshua Thomas Noble Anderson (1865-1949), Engineer: A Biographical Sketch"*, that he delivered to the 1998 Engineering Heritage Conference in Ballarat. [Anderson was John Monash's partner in their engineering consulting firm in the early years of the 20th Century.]

As mentioned previously, Brian regularly attended many Engineering Heritage presentations and tours, and delivered an historical retrospective *"The Heritage of Our Professional Status"* to Engineering Heritage Australia (EHV) in April 2009, in celebration of Engineers Australia's 90th anniversary. His talk explored the heritage of our professional status, and included the origins in the 19th century, the awakening to a professional consciousness as education developed in the federation decades, the formation of the Institution of Engineers Australia in 1919 and the early motivation and objectives of the Institution, the social and professional objectives in the 1930s, the search for status and reward to 1961, the highlight years of professionalism to 1990, and the social change and the challenge of the Professional Ethos. Apart from the historical narrative, Brian gave us a talk from the heart about the social changes that he had seen, some good - like the recognition of professional engineers in the 1960s, some bad - like the perceived weakening of the professional status of Engineers Australia when it broadened its membership base to include technicians and associates.

Ken McInnes

Editorial

I hope you enjoy some of the stories in this issue of the EHA magazine. These cover a range of engineering and industrial heritage, from the 2000 year old Pantheon in Rome to early canals and railways of the 18th and 19th Centuries, to an early 20th Century Woolscour in Queensland, to the mid to late 20th Century *Concorde SST*, and to the 21st Century Falkirk Wheel, raising and lowering canal boats between the Union and the Forth and Clyde canals in Scotland.

This June issue of the magazine is a bit late in coming out – mainly because I dislocated a shoulder and tore the deltoid muscle of my right arm, and couldn't type, write, or use a mouse for the six weeks I should have been writing and putting the magazine together. The accident happened when I tripped over an unmarked shallow step under a sliding door at the entrance to a petrol station shop. The subject of steps – marked or unmarked – at the entrances to buildings the public may use, has been in my consciousness for a very long time – ever since a paraplegic architect friend began campaigning for easy wheelchair access to all public buildings back in the 1960s. She had a certain amount of success over the years, but the question of providing easy access to important heritage buildings, without compromising their significant appearance, has remained a vexed one. It's an odd and ironic coincidence that one possible, if expensive, solution appeared in my Inbox four days before my accident. Have a look at: http://www.youtube.com/watch?v=Qo0ZGkYik28 (but ignore/turn off the preliminary ad.). Of course such a solution would be ridiculous for the step I tripped on. All that needs is a concrete or bitumen apron sloping gently up to floor level – mandatory now, but not when this service station was built.

Regarding the hammerhead crane at Garden Island in Sydney Harbour – it was announced in August last year that it was to be demolished and I mentioned this in the December 2013 issue of this magazine. When it appeared to be still intact in March this year – and being re-painted, the question asked was why? Has it been reprieved? I was very curious and thought some of you might like to know. Richard Mackay of GML Heritage told me: *The current 'repainting' works are part of the initial stages of the Hammerhead Crane removal works. The contractor is spraying a PVA coating across the structure to encapsulate the flaking lead paint. This is being done to ensure an environmentally safe removal process during works and in transportation. There is a comprehensive archival recording process under way and the approval includes other mitigative measures, including salvage of components and an interpretive exhibition.*

From the Chair – Keith Baker

Engineers Australia provides an opportunity from time to time for the chairs of each of its Colleges, Technical Societies and Special Interest Groups to meet with the President, CEO and the senior management team to share developments and planning issues.

Keith Baker

Since all the member groups fall under the broad guidance of the EA Director of Engineering Practice, the meeting is known as the Engineering Practice Advisory Committee. At the March 2014 EPAC, I took the opportunity to share the plans that Engineering Heritage Australia is developing regarding training in heritage conservation for practising engineers. I set out the need for awareness of heritage obligations and the opportunities for engineers in a wide range of disciplines beyond structural engineering to become engaged in the conservation of significant engineering works and in the sensitive provision of modern services associated with the adaptation of historic buildings.

EPAC endorsed in principle the new thrust of EHA to provide training modules for practising engineers to provide a means of entry into heritage work and the beginning of a pathway to recognition as certified Conservation and Heritage Engineers. I also received indication of support from some Colleges and Technical Societies in the development, testing and promotion of the training program. We have a big task ahead of us but I found this support very encouraging.

The Chair on Tour – Keith Baker travels to Victoria & S.A.

Immediately after EPAC my wife and I set off interstate for a holiday through Victoria and South Australia. Since heritage interpretation has been on our agenda I have been very mindful of the multi-disciplinary and cross cultural interpretation provided at a number of places we visited, including Mungo National Park and the Wadlada Outback Centre at Port Augusta. At both of these the parallel coverage of natural and cultural heritage, with time scales explaining geological changes, flora and fauna spread and decline, and Aboriginal and European inhabitation and development, were interesting challenges well handled. Three places that stood out for their engineering heritage significance were the Psyche Bend Pumping Station at Mildura, the Humphrey Pump at Cobdogla, and Morphett's engine house at Burra.

The Psyche Bend engine and pumps were designed by George Chaffey in 1888 as the foundation of the Mildura irrigation scheme. It features an unusual triple expansion steam engine with four cylinders but three connecting rods, directly coupled to centrifugal pumps at either end.

The Chaffey designed vertical triple expansion pump engine on the Murray River at Psyche Bend near Mildura, Victoria. Photo Keith Baker

Notes on the Chaffeys, borrowed from a 2008 article by Owen Peake

The Mildura and Renmark irrigation schemes and town plans were developed by the Chaffey brothers. George Chaffey was a competent mechanical engineer and had considerable experience with irrigation schemes in California. He engaged the British engineering firm Tangyes of Birmingham to build two very large triple expansion steam pumping engines to his own design & exacting specifications. Both engines survive and the one at Psyche Bend Pumping Station is in steamable condition and is run several times a year. The old engine drives three centrifugal pumps directly from the crankshaft and was the main first-lift pumping engine for seventy years.

The Chair on Tour – Keith Baker travels to Victoria & S.A.

Water towers & discharge pipe of the Humphrey Pump at Cobdogla

Psyche Bend Pumping Station, Mildura is worthy of recognition by EHA for its restored engine and pumps which were key to the irrigation of dry land in North-eastern Victoria. The vertical triple expansion engine has the high pressure cylinder above the intermediate pressure, operating in tandem, with a low pressure cylinder on either side.

Producer Gas Plant at Cobdogla Steam & Irrigation Museum

Ignition chamber of the Humphrey Pump.

The Cobdogla pumping engine in the South Australian Riverland is unusual as a four stroke producer gas engine without pistons. One of the pumps is restored to operate with a U-tube cylinder in which a column of water acting as the piston "bounces" to discharge part of the water at the top of the power stroke, in turn allowing the remainder to drop to expel the burnt gas, then rebound to take in more water from the well below and induce a fresh charge of gas and air, and fall again to compress the gas for ignition and a new power stroke. As the only Humphrey engine capable of operation in the world, it was recognised by EHA in 2010 and by the British Institution of Mechanical Engineers in 2011. Such independent international interest has prompted EHA to look even more closely at coordination of its international recognition options.

Producer gas charge holders at Cobdogla

Exterior of the Burra engine house, S.A.

Model Beam Engine in the Engine House at Burra

The reconstructed engine house at Burra is a Mine Museum managed by the National Trust. It features interpretive material covering the development and operation of Cornish beam engines for pumping water from mines. The engine house at Burra is unusual as a beautifully reconstructed 19th Century building used to interpret the history and operation of Cornish pumping engines through film, model, poster and guide. Unfortunately it has no surviving engine. The group of Cornish mining sites on the Yorke Peninsula are being considered as a serial site to broaden the World Heritage recognition accorded in Cornwall.

Keith Baker, Chair Engineering Heritage Australia

Upper Level of the Burra Engine House

For more information on the Humphrey Pump, go to:

https://www.engineersaustralia.org.au/sites/default/files/shado/Learned%20Groups/Interest%20Groups/Engineering%20Heritage/Register/Humphrey%20Pumps,%20Cobdogla%20Nomination.pdf

EA Recognises Queensland's Blackall Woolscour

A Unique Reminder of the Great Days of Wool Growing

Panorama of the Blackall Woolscour in 2009 Photo Brian McGrath

A hundred years ago, there were possibly more Merino sheep in central and western Queensland than in any other pastoral region anywhere else in Australia. Due to the nature of their wool and the natural lanolin on it, the sheep in these hot, dry and dusty districts collected a great deal of dust and dirt – sometimes up to 40% of the total weight of the shorn fleece. Sending wool in this condition to market could halve the price received by the owners and almost double their freight costs. The solution was to wash the wool before it went for sale. In Victoria and NSW in the early 19th Century, the graziers followed the English tradition and set up sheep washes in the nearest creeks and rivers, but this became impractical as the flocks changed from hundreds to thousands upon thousands of sheep and moved further and further north into the dry and comparatively waterless plains of western NSW and central Queensland.

Washing (or scouring) the shorn fleece was far more practical. Hand washing began in the 1840s, but industrial methods of scouring soon prevailed and by the 1890s, steam driven mechanised wool scouring factories were the norm. Down south, a few factories developed in the major urban centres, but far out in western Queensland, with great distances to travel, very slowly, it was worthwhile setting up mechanised woolscours in all the major sheep grazing districts. Between the 1890s and the early 1920s, mechanised scouring plants were set up in Charleville, Barcaldine, Ilfracombe, Blackall, Longreach, Winton, Julia Creek, Richmond, Maxwelton and Alba near Hughenden. The Blackall Woolscour was the last to close down (in 1978) and is the only one to remain intact.

Hand wool scouring in Blackall began in 1893, but the development of a mechanised scour was delayed until the construction of a railway line to Blackall, started in 1905. A company was set up by local graziers to develop a site a couple of miles out of town. Their first action was to call tenders for a bore, which, after drilling started in 1906, found suitable hot water (58°C) at a depth of around 780 metres early in 1907.

Artesian bore, woolscour (rear) & powerhouse (right) Photo B.McGrath

View of the Wool Scouring Company at Blackall, Queensland, 1908.
Photo - John Oxley Collection, State Library of Queensland.

By 1908, when the woolscour opened for business, a conglomeration of structures was complete, including a railway siding, the bore, settling ponds, the L-shaped partly two-story woolscour, with contiguous workshops, blacksmith shop, boiler house, shearing shed and sheepyards. A manager's house and shearers' quarters with kitchen and meat houses would have been apart from the industrial structures.

I haven't seen a plan of the site as it is today, but the layout of the buildings seen in the 2009 photo (top) is remarkably similar to a 1908 photo held by the John Oxley Library photo collection (above), even to the tall boiler chimney. However the powerhouse building to the right of the chimney is more recent than 1908, as is the small garage next to it.

The builders were Messrs Renshaw and Ricketts, a well established firm from Rockhampton. The designer of the buildings is unknown, but it was probably the same person who selected the plant – someone with experience in commissioning and operating mechanical woolscours who obviously knew what he was doing. After all, the woolscour continued operating, in the same buildings, with the original scour line still in use (plus a second line installed 1915), for the next 70 years.

At shearing time the flocks from each of the various local sheep stations were brought in to Blackall in turn and yarded at the woolscour. The sheep were shorn on site in a 20 stand shearing shed next to the woolscour and the fleeces picked up and carried into the scour. The scour lines consisted of narrow troughs with rows of forks which stirred the wool in hot soapy bore water, until it was clean enough to be moved to the next trough and the next.

Part of the 20-stand shearing shed adjacent to the woolscour.

Inside the Blackall Woolscour 1908 From John Oxley Collection, Qld State Library

An operating scour line in 2009 Photo Brian McGrath

Detail of the original 1908 McNaught scour line.

At the end of the line the wool went through sets of rollers which squeezed out the water and passed the wool on to hot air dryers and thence to the wool presses for baling.

The 1908 scourline came from Petrie & McNaught, an interesting firm in Rochdale, Lancashire in the heart of the textile mill country. The company was founded by Alexander Petrie in 1792, became Alexander Petrie & Son in 1816, made theirs and Rochdale's first mill steam engine in 1818, and hired Wm McNaught as factory superintendent and engine designer about 1838. The firm became renowned for its ever larger steam engines, and for the first automatic Wool Washing Machine, patented by John Petrie in 1853. William McNaught left the firm in 1858, and set up a rival firm, also in Rochdale, which competed with Petries for at least the next 20 years, until J&W McNaught (William's sons) re-amalgamated with the Petrie family as Petrie & McNaught. At that time, and for much longer, the combined firm manufactured everything needed to set up a large scale wool scouring business – the scouring line tanks and machinery, rollers, dryers, steam engines and even boilers. The firm is said to *have made most of the wool-washing and carbonising plants in use throughout the United Kingdom and abroad.* It became a public company in 1920 and was still manufacturing washing and drying machines in the 1960s.

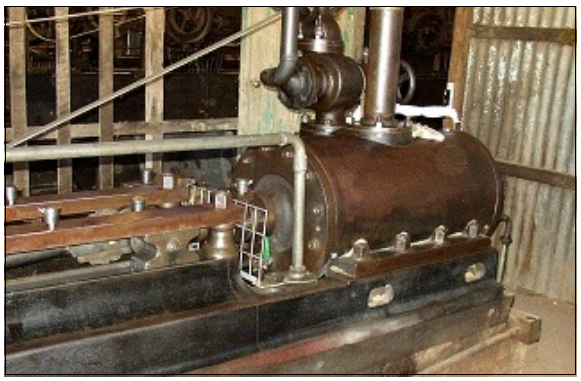
Blackall Woolscour – a Unique Reminder of the Great Days of Wool Growing.

A growth in the market for wool, probably due to the start of WW1 (production from the scour doubled between 1913 and 1918), led to the installation of the second scour line in 1915. This came from another interesting firm – Hall Brothers, of Clifton Hill, Melbourne. Robert Hall came to Melbourne in the 1850s from Yorkshire. He worked as a staircase builder until 1869 when he set up an engineering works to manufacture a mechanical wool scouring machine of his own design. It seems a huge jump from stair-building to engineering works, but perhaps the stairs were the cast-iron variety. A testimonial advertisement reproduced in Gary Vines' *Northern Suburbs Factory Study* has a small drawing of a wool scour above the text: *"Hall Bros & Co., Wool Scourers, and Makers of Hall's Patent Wool Scouring and Dag Crushing Machines"* etc. Hall's five sons joined Robert Hall in the business in the 1880s and by 1890 they were no longer scouring wool at the Clifton Hill factory *and the firm concentrated on making improved types of wool scouring equipment and setting it up in various locations in outback NSW and Queensland for big sheep stations.* The firm was still making woolscouring plant up to WW2 and was still operating, like Petrie & McNaught, through the 1960s. Vines notes: *Hall Bros made a significant contribution to the Australian woollen industry, particularly in the promotion of sheep station based scouring which greatly reduced the weight, and therefore cost, of transporting wool.*

It is quite remarkable that the Blackall Woolscour continued operating until 1978, and that the buildings and machinery remained intact until the Blackall Historical Woolscour Association Incorporated was able to rehabilitate the buildings and bring much of the machinery back into working order. It is said to be the only such early 20th Century woolscour still surviving into the 21st Century. There are still a few commercial woolscours around – maybe three in Melbourne and one or two in other cities, but none would be operating with machinery of any great age. Today, Blackall is the only place in Australia where the public can watch the whole process of washing the fleece, drying and baling it, complete from the original 1908 line of tanks and the overhead line-shafting driving the forks, to the later steam engine driving the belts and pulleys. The original wood-fired fire-tube steam boilers have disappeared, or are disused, and were replaced in 2001 by an oil-fired water tube steam boiler.

The restored steam engine which it is understood operated both scour lines for many years is said to be the 1908 engine, but could be the engine that was first installed in 1915 with the second scour line. Its manufacturer is not known, but it could possibly have been made in Australia, or bought secondhand, since the second scour line was made in Australia, and it must have been difficult to import such machinery from the UK in 1915.

Flywheel of the steam engine. Photo B.McGrath



The restored steam engine now driving a scour line

One of the disused boilers still at the woolscour.

In May this year Engineering Heritage Queensland organised the awarding of an Engineering Heritage National Marker to the Blackall Woolscour. The Woolscour is highly significant for many reasons, only a few of which are: its links with the British firm of Petrie & McNaught, and John Petrie Jnr, the patentee of the first mechanical woolscour; its links with Hall Bros. & Co., the first Australian designer and manufacturer of mechanical wool scours; its rarity as the sole surviving commercial woolscour in Australia from the beginning of the 20th Century; its illustration of vanishing technologies such as steam engines driving belts and pulleys via lineshafts to operate machinery; it demonstrates the huge importance of the wool industry in the development of rural Queensland; and, since the Woolscour re-opened it has become an extremely popular national tourist destination, of great educational value to students, adults, and (dare I say it?) engineers. Formal statements of significance can be found in the Queensland Heritage Register and Brian McGrath's nomination document.

From the Editor

References:

The information on Hall Bros & Co. comes from Gary Vines' *Northern Suburbs* [of Melbourne] *Factory Study* – see http://www.academia.edu/1986285/Northern_Suburbs_Factory_Study_Part_2_Citations_2_ .

The information on Petrie & McNaught came from a variety of internet sources, starting with *Grace's Guide (to British Industrial History)* at http://www.gracesguide.co.uk/Main_Page and (of course) Wikipedia.

The principal sources of information on the Blackall Woolscour were the Queensland Heritage Register entry on the Woolscour (Place ID 600033) and Brian McGrath's Engineering Heritage Queensland nomination document for EHA recognition of the Blackall Woolscour.

The unacknowledged photographs (above) and more information came from the website http://www.travelling-australia.info/, the *records of several years of caravan travelling around Australia by a couple of grey nomads.*

The Dawn of Early Railways in Australia

An Invitation to Subscribe to "Early Railways 5" – from Keld Fenwick.

[The publisher[1] of this new book sent me this story, rightly assuming there would be some interest in Australia because of the strong representation of authors and papers from Australia and New Zealand. The image below will be on the cover of the book. – Ed.]

"The Festiniog Railway at Work, 1846. Image courtesy of Ironbridge Gorge Museum Trust – AE185.200

For students of early railways, this, the latest book on the subject, will have three papers exploring the development of pre-mainline railways in Australia and New Zealand.

Jim Longworth and **Phil Rickard** set their paper in the time frame 1788-1855 when the Sydney-Parramatta railway opened. They pull together the scanty information about the first Australian railed-ways, as they call them, starting with the sketchy records of Darlington Jetty, Maria Island in Van Diemen's Land which was operating in the 1820s. The paper then surveys 44 known rail projects. The locations are wide-ranging and include Newcastle, Sydney, the Tasman Peninsula, Norfolk Island, Lake Macquarie, Wollongong, Port Phillip District, Gabo Island, Adelaide, Fremantle, Port Elliot, Bathurst, Melbourne and others. Many of the lines were built to exploit coal reserves but other uses include slipways, and the carriage of stone and aggregates, ores, timber, general goods and even passengers. Construction and operating methods are discussed in many cases and in general mirror principles used in the UK.

Rod Caldwell, **David Campbell** and **John Brougham** contributed a paper explaining the Australian Agricultural Company's first coal mine and railway, based on the evidence available until 2004. It opened in Newcastle on 10th December 1831 and is claimed to be Australia's first. The discovery of a cast iron fish-bellied rail showed how British practice of the 1820s had been in use on the railway. The paper is extensively illustrated with maps, photographs and diagrams and makes many other comparisons.

Professor Ian Carter and **Dr Ellen Carter** explore the beginnings of railways in New Zealand which grew on a shoestring budget and overcame formidable natural obstacles to open up the country. A section on 'Antediluvian Oddities' tells the stories of the Great Northern Railway (known later as the Oreti Railway), Prosser's patent system for flangeless wheels, bush tramways, and the Denniston Incline with its vertiginous tracks.

The volume, edited by **Dr David Gwyn**, has 21 papers with an introduction and index. For the first time in the history of the series, it has a significant amount of colour. This is used sensitively to help readers interpret diagrams as well as to render illustrations in their original colours. It is being published as a subscription volume and subscribers will have their contributions acknowledged in the preliminary pages. The subscription price is £39 (full retail price £55), including international post and packing, and the subscription list will close on 1st September 2014, with publication shortly after.

For a full list of the contents and ordering information go to www.earlyrailways.org.uk. Published by Six Martlets Publishing, 4 Market Hill, Clare, Sudbury CO10 8NN UK, (e-mail sixmartlets@uwclub.net) on behalf of the sponsors, the Institute of Railway Studies & Transport History, the Railway & Canal Historical Society and the Newcomen Society.

1 The publisher of *Early Railways 5* happens to be another engineer in my family – my cousin, Keld Fenwick. Keld has been the editor of the UK Institution of Mechanical Engineers magazine *PE* and then editor of the Newcomen Society's *Links* Magazine. He is now the proprietor of Six Martlets Publishing in the UK. We don't see each other very often and it was only about 15 years ago that we discovered our mutual interest in engineering heritage and industrial archaeology. Keld contributed information for the story on page 22 about the IMechE heritage recognition of Concorde.

Engineering Heritage in Manchester & Beyond.

Australian engineers join a Newcomen Society tour.

Owen Peake and Keith Baker and ten other Australians joined about 40 British people on a Newcomen Society Summer Tour of Engineering Heritage sites in the Manchester region through a week in July 2013. Owen and Keith both wrote articles about the tour, but whereas Owen's was a general overview of the week, Keith concentrated on the historic British canal system and how the canal designers overcame the problems of level changes in waterways. To save repetition, I have edited out Owen's references to the canals they visited. I hope I will be forgiven.

For those who are unfamiliar with it, the Newcomen Society, based in London, was founded in 1920 and is the oldest society in the world specialising in the history of engineering and technology. It takes its name from Thomas Newcomen (died 1729), who invented the first practical working steam engine. I like to claim a family connection with the Newcomen. Until a few years ago my cousin Keld Fenwick was editor of Links, the Newcomen Society magazine, and the idea of this EHA magazine was partially modelled on Links. The Editor.

EHA Engineers take the Newcomen Manchester Tour – Owen Peake

The Manchester region (and far beyond) is packed with Engineering Heritage sites so the problem for the organisers was what to leave out rather than what to leave in. In the event the tour covered sites from many disciplines and from almost pre-Industrial Revolution times up to modern industrial sites.

The tour started with a day in Yorkshire to visit the National Railway Museum in York and the National Coal Mining Museum at Caphouse Colliery, Overton on 15th July. These two large scale national museums are impressive. The National Coal Mining Museum includes an underground tour which is both extensive and very entertaining using ex-miners as expert guides of the workings below the museum.

The "Evening Star" at the National Railway Museum in York – built in Swindon in 1960, it was the last steam loco built for British Railways.
Photo Owen Peake

The National Railway Museum was hosting a collection of the remaining six A4 class streamlined steam locomotives brought together from around the world to celebrate the 75th anniversary of the record run of *Mallard,* one of their number. "*On 3 July 1938, the A4 class locomotive Mallard raced down Stoke Bank at 126 miles/hour (202 km/hr) to set a new steam locomotive world speed record. That record still stands*".

The afternoon of the 16th July was spent at the magnificent Museum of Science and Industry in Manchester. This museum (now part of the Science Museum group of museums) is quite multi-disciplinary, however it has a strong emphasis on steam power, the cotton industry, the electricity supply industry and railways. The museum also houses an impressive aeronautical collection and the important "Manchester Baby" computer, claimed to be the first "stored program" computer.

Looms at Quarry Bank Mill. Photo Owen Peake

The following day we visited Quarry Bank Mill, Wilmslow. This old mill features Europe's largest operating water wheel and a range of operating textile machines including spinning mules, looms and carding machines. As with many older water-powered mills steam power was added later to augment available horsepower and to operate through periods of water shortage. The steam plant remains in place.

Looms at the Queen St Mill at Harle Syke near Burnley. Photo Owen Peake

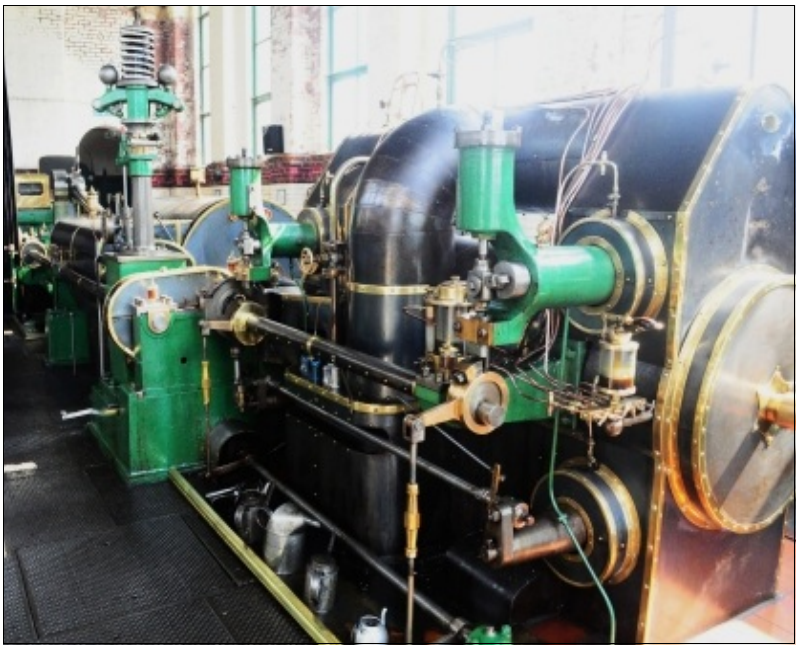
The next day concentrated on the textile industry with a visit to Queen Street Mill at Harle Syke near Burnley. This weaving shed has 308 Lancashire looms still in place driven by line shafting from a large tandem compound steam engine which was operating during our visit. This is probably the last complete weaving shed still in existence from the late 19th century.

EHA Engineers take the Newcomen Manchester Tour – Owen Peake

Spinning mules at Whitaker's Mill Photo Owen Peake

Helmshore Higher Mill is a water-powered wool fulling mill dating from 1789. The curious process of fulling and the ancient "hammer type" fulling mills are well demonstrated at this mill.

Then to Whitaker's Mill, which is a cotton spinning mill for "condenser" yarn. "Condenser spinning is used to produce thick yarn from low grades of cotton and from cotton waste". This mill dates back to the 1820s and was rebuilt in the 1850s. The image shows typical Lancashire Spinning Mules - the very heart of the Lancashire cotton trade.



Steam engine at Ellenroad Ring Mill. Photo Owen Peake

The final visit of that day was to what is left of the huge Ellenroad Ring Spinning Mill. Unfortunately all that is left of this mill is the engine house. However this contains the jewel in the crown of cotton mill engines – the 3000 horsepower, McNaught twin tandem-compound engine which was run for us by special arrangement.

The following day mainly featured visits to more modern manufacturing plants. First stop was a brand new paper mill making brown paper for corrugated cardboard packaging. The plant, at Partington, operated by the Spanish company Saica consists of a single very large paper making machine which produces 400,000 tonnes of recycled paper per year operating at production speeds up to 1,500 m/min. The group then split with one section going to the Land Rover assembly plant at Halewood near Liverpool where Land Rover Freelander II and Range Rover Evoque vehicles are manufactured for the world market. The plant is operating three shifts per day and still has a significant backlog as demand for these up-market vehicles, particularly in the Far East, is relentless. A second group rode on the East Lancashire Railway heritage train between Bury and Rawtenstall, north of Manchester.

The next morning saw a visit to the Lion Salt Works at Marston, well south of Manchester. This salt works extracted salt from brine mined from the site by bores, and concentrated in large open evaporating tanks mounted above furnaces. The site operated from 1894 to 1986 and is currently undergoing extensive restoration. The image shows a very ancient beam pumping arrangement for lifting brine from the salt measures. It was driven by a small conventional horizontal steam engine. This was one of the few parts of the site not covered with building scaffolding as the site was under massive restoration.

Beam pump at Lion Salt Works Photo Owen Peake

EHA Engineers take the Newcomen Manchester Tour – Owen Peake

The final event of the tour, the next morning, was a walk around the old industrial areas of Ancoats in inner Manchester along the Rochdale Canal. This area contains many heritage mills and warehouses as well as old canal infrastructure but there are also many new developments and open space for future developments. It was interesting to see such large-scale redevelopment near the centre of an old industrial city.

A typical street of old mills and warehouses in the Ancoats district of Manchester. Photo Owen Peake

The old Ancoats Dispensary has become a cause for heritage-minded people in Manchester. It was in the process of being knocked down but protesters have taken over the site for about a year and are keeping the wreckers at bay. There is plenty of vacant land in the area and nobody sees a need to demolish an important old building. The protesters are winning and have not been moved on by the authorities. Even in England the good fight goes on!!

The Ancoats Dispensary protest site. Photo Owen Peake.

Many of the participants in this tour had arrived before the Newcomen Society tour or stayed on afterwards to do their own exploration. The Newcomen tour was a fantastic experience and those who participated would like to sincerely thank the Newcomen Society for inviting us to join them on their Summer Meeting.

Owen Peake
EHA/EHV

Warehouse & canal lock at Ancoats O.Peake

Owen Peake's photo at left, of a typical Manchester warehouse and adjoining canal and canal lock makes a good lead-in to Keith Baker's story about how level changes are achieved in canals – how the narrow boats could be made to travel over hills and across valleys carrying the raw materials and manufactured goods of Britain to and from the markets and ports, long before railways and steam locos and internal combustion engines running on sealed roads were imagined.

The English canal system had its origins in river navigation "improvements" instigated by Acts of Parliament in the 16th Century. The first true canal was possibly the Exeter Canal, built to extend the navigational reaches of the River Exe in 1566. The Kennet & Avon Canal, providing a waterway connecting Bath and London, was one of the last. It was completed by John Rennie's famous 1810 Caen Hill flight of 29 locks rising 237 feet in 2 miles. The Bridgewater Canal from Manchester to the coal fields was completed much earlier, in the mid 18th Century.

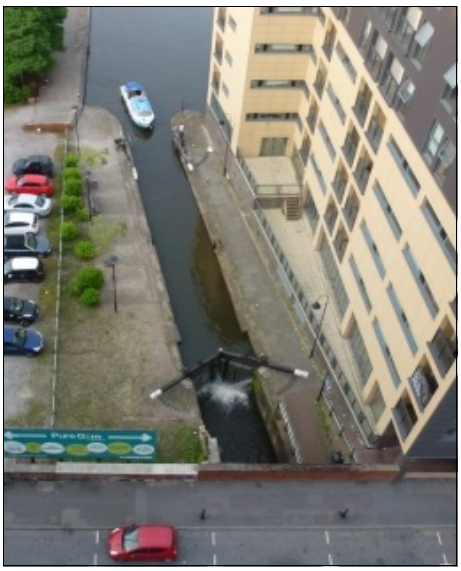
The early major railways were built around the 1830s and 1840s, but their success as freight carriers, competing with canals, came relatively slowly. By 1860 the railways were taking over, but some of the canals survived in commercial use well into the 20th Century – simply because one tow horse could pull a narrow boat with about 30 tons of cargo. Diesel powered boats were replacing tow horses by the 1930s in some of the canals. Now the canals survive on the tourist trade.

From the Library of the Editor
With additional acknowledgements to Wikipedia

EHA Engineers take the Newcomen Manchester Tour – Keith Baker
Level Changes Between Waterways

The industrial revolution involved a gradual change from cottage industry production to large scale mechanised factory production. The main elements allowing this transformation were the invention and manufacture of machinery, the development of energy to drive it and transportation to handle the raw materials and finished goods. All of this involved unprecedented engineering challenges and social change, with Manchester at the heart of the revolution. The Newcomen Society Summer Meeting was an exploration of industrial revolution issues relating primarily to the cotton industry, with its spinning and weaving products giving rise to the term *Manchester*. We learnt about numerous examples of machinery development and deployment coupled with appalling working and social conditions, and associated water and steam driven overhead line shafts, as well as the birth of rail transport. But the aspect I want to concentrate on is water transport on canals, and in particular the changes in level needed to allow narrow boats to travel up and down over hills, to transfer from one canal system to another, or to allow larger ships to cross the path of a canal at a different level.

The common issue with all canals is changes in level with the contours of ground being traversed. We had an immediate illustration of the conventional lock system with one outside our hotel at Manchester, as part of the Bridgewater Canal system. Locks achieve the change in level by containing the canal boat (or boats) between wooden gates at either end of a stone channel, where the water level can be raised by admitting water from upstream, or lowered by releasing water downstream. After the desired change in level has occurred the journey can be continued by opening the gate at one end only in the direction of travel. Locks require an adequate reservoir of water upstream to allow for the loss of a lock–full of water each cycle of operation, as well as fairly constant leakage past the wooden gates. Such locks were integral to the design of canals from the 1700s, allowing transport of barges containing bulk materials to be towed by horses before road transport could compete for cost or reliability. Early containerisation of coal in barges was illustrated along with locks and other waterways history at the National Waterways Museum at Ellesmere Port, Cheshire.



Bridgewater Canal lock passes under a roadway in Manchester Photo K.Baker

The lock flight at Marple on the Peak Forest Canal illustrated to our party one solution to a fairly rapid change in terrain. Sixteen locks in a row ran down from the road where we alighted from the bus to drop 209 feet over the course of a mile, reaching an aqueduct and parallel rail bridge crossing a deep ravine. The locks had become dilapidated and closed commercially in 1960, but were restored by volunteer groups and reopened in 1974. Problems with drainage of overflow water and ongoing maintenance were evident as we walked between the canal and houses of the local village, including the former lockmaster's cottage.

Peak Forest Canal – top lock (No.16) on the Marple lock flight. Photo Keith Baker

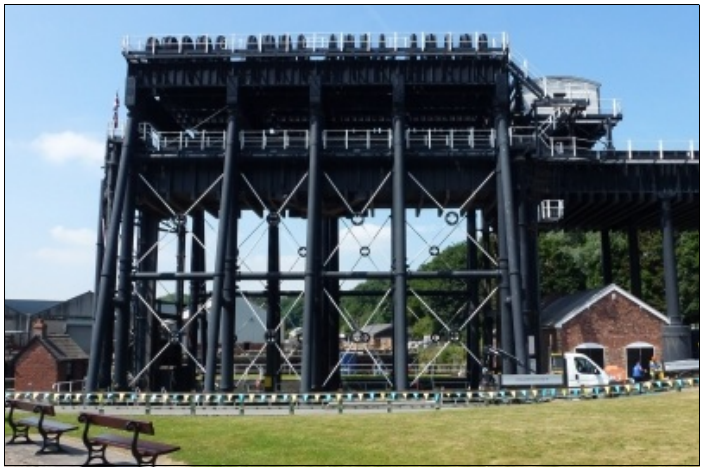
On reaching the bottom of the flight we were lucky to be met by a young couple on a narrow boat who crossed the aqueduct and commenced the task of opening, entering, filling and exiting each of the 16 locks in turn; quite a physically demanding task for the one who opted to handle the locks rather than driving the boat.

It is not possible to view the whole chain of locks from one point (unlike the Caen Hill flight on the Kennet & Avon canal at Devises), but a short history containing an excellent diagram with the locks numbered and structures shown can be found at:
http://www.marplelocks.org.uk/marple_locks_guide.pdf *Editor*

Marple Railway Viaduct viewed from the towpath of the Marple Aqueduct. The Aqueduct passes under the railway at the end of the Viaduct. Photo K.Baker

EHA Engineers take the Newcomen Manchester Tour – Keith Baker
Level Changes Between Waterways

An alternative approach to achieving a rapid change of level was seen at the 1875 Anderton Boat Lift. This enabled a canal boat we boarded to transfer from the higher level Trent and Mersey Canal to the 50 feet lower River Weaver Navigation system, via a single vertical step. Originally built as a balanced hydraulic lift, it allowed one boat to be raised as another was lowered, or even two boats side by side in each of the 75ft long wrought iron boxes or caissons. The lift operated by vertically transporting the boats in watertight caissons with doors at each end. These connected with a matching aqueduct at one end at the higher canal level and at the opposite end at the lower river level. After connecting with the aqueduct at the top, and with the water in the caisson and the aqueduct at the same level, watertight doors on the aqueduct end could be opened to allow a boat to enter.



Side view of the Anderton Boat lift. Photo Keith Baker

Upper Level of the Anderton Boat Lift. Photo Keith Baker

The doors would then close to allow the caisson to make its descent to the dry well below, supported in the air by the hydraulic piston. On connecting with the lower river level the doors at the river end of the caisson could open to allow the boat to exit. During this process there was virtually no water loss and the descending caisson and boat equalled the weight of the ascending caisson full of water, or with some of its water displaced by an equal weight of boat.

Although the water hydraulic system operated effectively, it suffered from corrosion of the pistons through working with brackish water. In 1908 the hydraulics were replaced with two independent electrically powered rope drives with counterweights, and the structure was strengthened to take the additional load. The converted lift then operated successfully for a further 75 years until 1983 when it was declared structurally unsound. At a cost of seven million pounds in 2002 it was restored to its original hydraulic operation, but using oil hydraulics instead of water. The pulleys and external frame were retained in a non-operational role and the counterweights remain at ground level.

A highlight of our final canal boat ride was passing through the Barton Swing Aqueduct. When the Manchester Ship Canal was planned in the 1880s to bring ocean going ships to Manchester on an alignment that crossed the Bridgewater Canal it created another issue of canals at different levels. The Barton Swing Aqueduct was designed and built as a moveable navigable aqueduct to carry the Bridgewater Canal across the Manchester Ship Canal allowing large vessels using the ship canal to pass underneath and smaller narrow boats to cross over the top. The aqueduct, the first and only swing aqueduct in the world, was designed by Sir Edward Leader Williams and opened in 1894. Williams was the chief designer of the Ship Canal and had earlier designed the Anderton boat lift. Although the swing aqueduct was much longer than the boat lift, both would have had similar issues of strength and rigidity of the movable caisson, involving overhead bracing to help retain the vertical sides against the weight of water and enable gates at each end to reliably close and seal.

L-Swing Aqueduct, R-Swing Road Bridge.
Image – RuthAS, Wikipedia.

(R) Keith's photo, using a tele lens, shows the control tower and the swing road bridge beyond, taken from a canal boat crossing the swing aqueduct. The no-smoking sign is on a perspex screen on the canal boat.

(L) The tower and the pivots for the aqueduct and road bridge are on a long, thin island built in the middle of the ship canal.

Editor

Control Tower, Barton Swing Aqueduct. K.Baker

EHA Engineers take the Newcomen Manchester Tour – Keith Baker
Level Changes Between Waterways

After the Newcomen tour some individuals in the group separately inspected a modern equivalent of the Anderton Boat Lift – the Falkirk Wheel in Scotland. In principle it operates similarly in raising or lowering canal boats in watertight caissons or tanks, connecting in this case, the Forth & Clyde Canal with the lower Union Canal.

This rotating boat lift opened in 2002 at a cost of £17.5 million for the wheel and £84 million for the entire project. The wheel lifts boats 24 metres (79 feet) and replaces a flight of 11 locks that had fallen into disrepair and had been filled in.

The Falkirk Wheel Basin, Visitors' Centre (rear), entry aqueduct from the Forth & Clyde Canal (right), and the Wheel itself (centre right). View from West. K.Baker

Instead of a vertical lift, the two caissons are arranged diametrically opposed on a large wheel which rotates to exchange upper and lower positions through a dry well, while the caissons with their boats remain horizontal in smaller circular mountings within the wheel.

Their stability is assured while the wheel turns, through two large ring gears and an idler wheel in between. Balance of the wheel is maintained by the caissons being always full of water, and, as with the Anderton Lift there is minimal water loss.

The Falkirk Wheel viewed from the South.. Photo Keith Baker

The Falkirk Wheel in mid-rotation, viewed from the North near the Union Canal entrance, showing the end of a canal boat lined up to enter the caisson. Photo Keith Baker

Apart from the means of rotation or lift, design issues would have been similar regarding the need for rigidity of the caissons and water sealing of their gates. The housing of the Falkirk Wheel caissons in their own circular enclosures is a neat solution in creating horizontal restraint which fits in with the circular motif used extensively in the fixed structure.

Keith Baker

EHQ Secures a Community Heritage Grant for its Archives

In 2011, the Engineering Heritage Australia Queensland Panel (EHQ) commissioned a Collection Policy, by a local qualified Consultant Archivist, for the Heritage Archives of Qld Division. Following that an evaluation was done to identify software products for the control and management of the Qld Division Archives. This recommended that a commercial software product be purchased to provide management of all the archival records, photographs, films, oral history, etc., and that suitable training be provided.

In 2012, EHQ made an application to the National Library of Australia (NLA) under the Community Heritage Grants scheme for funding for such software and training.

The Community Heritage Grants (CHG) program provides grants of up to $15,000 to community organisations such as libraries, archives, museums, genealogical and historical societies, multicultural and indigenous groups. The grants are provided to assist with the preservation of locally owned but nationally significant collections of materials that are publicly accessible, including artefacts, letters, diaries, maps, photographs, and audio visual material. Since 1994, $4.9 million has been awarded to community organisations throughout Australia.

See the CHG website at: http://www.nla.gov.au/awards-and-grants/chg

EHQ Archive storage – the Whitmore Room.
Photo - Helen Bennett.

EHQ Library – the Davenport Collection Photo - Helen Bennett

On that occasion, our application was rejected, as the CHG process requires 3 stages to be followed, strictly in order:

1. A Significance Assessment must be made first to evaluate the collection for historic and research significance;
2. A Preservation Needs Assessment then looks at the physical condition of the collection, current housing and storage;
3. Conservation & Collection Management – the implementation of the recommendations of the preservation needs, covering conservation and management and training.

As a result of this, in 2013 EHQ made an application for a Significance Assessment grant of $4000. The application was successful, and was later carried out by a local Historian & Heritage Consultant and completed in March 2014. This extensive 51 page report proved a milestone in setting out the full value of the entire collection, and made important recommendations for its future management, and opened the way for us to proceed to Stage 2.

In addition, first time recipients of the grant were invited to send one representative to the Awards Ceremony and a three day Preservation and Collection Management Training Workshop held in Canberra .The workshop was conducted by the National Library of Australia, the National Archives of Australia, the National Film and Sound Archive and the National Museum of Australia, and covered all aspects of the CHG program.

In April 2014, EHQ made an application under the CHG for a Stage 2 grant – for a Preservation Needs Assessment. This included the already completed full Significance Assessment report. We will be advised of the results of our Stage 2 application later this year.

The EHQ panel are hopeful that by next year, it will be able to apply for funding under Stage 3 for a full management and training system. The process seems somewhat drawn out, but the stages are important in ensuring the best long term outcome and best value for use of grant money from the NLA.

Brian Becconsall, Deputy Chair, EHQ. 3rd June 2014

Two pages from the Story Bridge Album.
Photo – Helen Bennett.

A Report on the EHA Heritage Recognition Program

from Owen Peake, Chair Heritage Recognition Committee.

The Heritage Recognition Program had busy years in 2012 and 2013, and 2014 is looking even busier. The program has been under-reported in recent years with the old EHA Newsletter having a limited publication schedule and the new EHA Magazine only having its first issue published in December 2013. Not counting two ceremonies already held this year (Gairloch Bridge in North Queensland and the Blackall Woolscour in Central Queensland) there were 21 heritage recognition ceremonies in 2012 and 2013. Up to the EHA Magazine issue No.2 in March this year seven of these sites have been the subject of stories in the Magazine and there will undoubtedly be more in coming editions. However there may not be enough room to publish stories on all these sites, important as they are. The material below provides a very quick overview of those sites which have not been reported on as yet.

EHWA - Standard Gauge Railway Project – Fremantle to Kalgoorlie
Engineering Heritage Landmark Ceremony

The ceremony was held on the 26th March 2012 at the Public Transport Centre in East Perth and the EHNL plaque and Interpretation Panel have been mounted on a wall of that building.

Key features: This project was an important step in the building of a Perth to Sydney standard gauge railway to end the great inefficiency caused by the change-of-gauge in the various states. The project was executed between 1962 & 1972. It was a double line dual gauge which carried both standard gauge and narrow gauge trains (still used in much of WA).

Wheat train on the dual gauge track passing through a cutting in the Avon Valley Image - EA

Moorabool Viaduct on Geelong to Ballarat Railway. Peake

EHV – Geelong to Ballarat Railway
150th Anniversary Celebrations &
Engineering Heritage Recognition Ceremonies.

On 10th April 2012, two recognition ceremonies were held, one in Geelong in the morning and one in Ballarat in the afternoon followed by a commemorative dinner at the Ballarat Mechanics Institute in the evening.

Key features: Built in the wake of the Gold Rush to Ballarat this was one of the "Goldfields Railways" built in Victoria in the late 1850s. The other sister line went from Melbourne to Bendigo. These railways were built to high standards and feature spectacular bridges.

EHC – Canberra's Main Outfall Sewer
Engineering Heritage Recognition Ceremony
held on 28th April 2012

Key features: The 7 km Main Outfall Sewer was started in 1915 but delayed by World War One and not commissioned until 1926. It originally connected to the Western Creek Treatment Plant but now forms part of the connections to the Lower Molonglo Water Quality Control Centre.

Canberra Main Outfall Sewer crosses Yarralumla Creek. Image - EA

Perth Causeway Bridge Image Australia for Everyone

EHWA – Perth Causeway Bridges
Engineering Heritage Recognition Ceremony 19th September 2012

Key features: The crossing of the Swan River by what are now called the Causeway Bridges at the previously named Perth Flats area has long been a priority for road communications within the city of Perth. The first wooden bridges were built in 1840-43 with the current concrete and steel composite structures being built in the period 1947-52 when materials were in short supply following World War II.

EHQ – Barcaldine Water Tower, Queensland
Recognition Ceremony 23 June 2012

Key features: The water tower was the standout feature of a comprehensive country water supply system including bore, low level storage and a pumping system to raise water to the water tower. The 30 m water tower was completed in 1914 and has a capacity of 200 kL.

Image: Barcaldine Water Tower – from Engineers Australia.

EHWA – Carnarvon Tracking Station, Western Australia
Recognition Ceremony 23rd June 2012

Key features: Carnarvon was a very important Tracking Station for the US Space Program – partly because it was close to 180 degrees of longitude from the launch site at Cape Canaveral in Florida.

This site has an Engineering Heritage International Marker.

Image: Carnarvon Tracking Station, 9 metre tracking dish – from Honeysuckle.net

EHV – Fyansford Monier Arch Bridge, near Geelong, Victoria
Recognition Ceremony 12th October 2012

Key features: EHV has a sub-program to recognise significant bridges built by John Monash and Joshua Anderson (Monash & Anderson) prior to the First World War. Fyansford Bridge was the first Monash & Anderson bridge built to the Monier Arch patents and was completed in 1900.

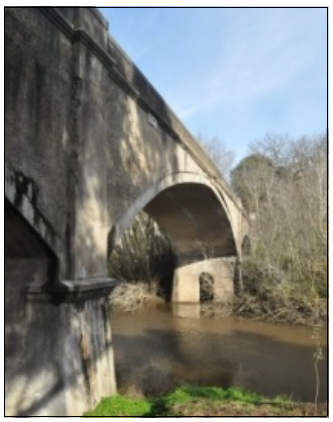


Image: Fyansford Monier Arch Bridge near Geelong – Photo Owen Peake.

EHV – Melbourne to Bendigo & Echuca Railway, Victoria
Recognition Ceremony 20th October 2012

Key features: Built in the wake of the Gold Rush to Bendigo and Castlemaine, this was one of the "Goldfields Railways" built in Victoria in the late 1850s. The other sister line went from Geelong to Ballarat. These railways were built to high standards and feature spectacular bridges.

Image: Malmsbury Viaduct on the Melbourne–Bendigo Railway – Photo O.Peake

EHWA – Perth's First Public Water Supply Scheme
Recognition Ceremony 22nd October 2012

Key features: Perth had no public water supply before 1887 when Perth engineers Saunders & Barratt designed a scheme with a 140 million gallons storage reservoir to be built in the Darling Ranges east of Perth, 16¾ miles of 12 inch main, and a service reservoir in Kings Park overlooking Perth. Contracts were awarded in October 1889 and site clearing commenced immediately. Cement and pipes were arriving from England four months later. Victoria Reservoir was opened on 1st October 1891. The original Victoria Reservoir wall has been replaced, as has the original service reservoir, but the sites remain in use for the same purpose today.

Image: The original Victoria Reservoir in the Darling Ranges near Perth – from EA.

EHS – Reefer Battery, Adelong Falls Gold Mill Ruins Reserve, Adelong
Recognition Ceremony 6th April 2013.

Key features: Reefer Battery is the best preserved of the many batteries at the extensive Adelong Goldfield. It started operation in 1858 and saw many modifications and innovations over 57 years of operation. Much stonework and some mechanical components remain.

Image: Adelong Falls Reefer Battery - from NSW Dept. of U.A. & P.

EHQ – Longreach Power Station, Queensland
Recognition Ceremony 17th May 2013

Key features: Longreach has one of the best preserved and most interesting regional power stations in Australia. The plant contains diesel and gas engines including a Producer Gas plant. The station was commissioned in 1921 and has had many additions and modifications. Plant installed since 1948 remains in place.

Image: Longreach Power Station – from Engineers Australia

EHQ – Hay Point No.2 Coal Loader near Bowen Qld.
Recognition Ceremony 14th June 2013

Key features: No.2 coal loader and its associated port facilities was commenced in 1972 and commissioned in 1975 to export coal from the Upper Bowen Basin. Its construction involved new technologies including significant off-site fabrication. The berth has now been upgraded to take ships of 250,000 tonnes.

Image: Hay Point No.2 Coal Loader near Bowen – from EA.

EHV – Wheelers Bridge at Lawrence, near Creswick, Victoria
A Monier Arch Bridge designed by Monash & Anderson.
Recognition Ceremony 15th June 2013

Key features: EHV has a sub-program to recognise significant bridges built by John Monash and Joshua Anderson (Monash & Anderson) before the First World War. Wheelers Bridge was the second Monash & Anderson bridge built to the Monier Arch patents and was completed in 1900.

Image: Wheelers Bridge at Lawrence near Creswick, Vic. – Photo R.Venus.

EHV – INTERSCAN Microwave Landing System, Tullamarine Airport Vic.
Recognition Ceremony 9th November 2013

Key features: The INTERSCAN Microwave Landing System (MLS) was an Australian invention which, in collaboration with the USA, became the International Civil Aviation Organisation (ICAO) worldwide standard for automated landing systems. Although not eventually widely adopted MLS remains the preferred system for the most crowded and difficult airports.

Image: Prototype INTERSCAN antennae at Tullamarine Airport – source unknown.

Roman Concrete

From our roving reporter in Rome – David Beauchamp

These two unprepossessing lumps of 2000 year old roman concrete, (opus caementicium) on the Palatine Hill in Rome[1] are said to be the cause of the fall of the Roman Republic & the rise of the Emperors.

In the 2nd Century BC engineers & architects discovered that mixing lime with volcanic sand (pulivis puteolanus) from Naples gave a mortar that was far stronger than the lime mortar used up until then. Embedding aggregate in this mortar created roman concrete.

The Times of 26th April 2014 reported that associate professor Penelope Davies of Texas argues that the use of roman concrete, which was a cheap material, allowed Pompey (a general & consul who was Julius Caesar's greatest rival) to build Rome's first permanent theatre as a way of asserting his authority over the city. He wanted to be regarded as the father of the city.

Relics of an ancient Roman concrete structure in modern Rome.
Photo - David Beacham

The subject lumps of concrete in the foreground of this view of their site on the Palatine Hill.
Photo - David Beauchamp

Months later Caesar hit back, ordering the building of a new forum & a massive development of a complex called the Saepta Julia[2] to prepare for his return from Gaul. When he became dictator in 48 BC, he embarked on an even bigger programme of concrete building, including plans to move the course of the River Tiber.

"What he's counting on is concrete" Professor Davies said, "to erect monuments to his power. One could even say it played a significant role in bringing down the republic."

The Pantheon, Photo – David Beauchamp

Later Emperors continued using concrete to erect monuments to impress the populace, the most famous concrete structure in Rome being the Pantheon, erected by the Emperor Hadrian.

The Pantheon, by Giovanni Panini, 16th Century

1. This concrete can be seen on http://wikimapia.org/#lang=en&lat=41.889879&lon=12.487778&z=19&m=b exactly under the cross at the centre of the image. To its left is the Domus Tiberiana. To its right is the Clivus Palatinus, an ancient road linking the Foro Romano & the Emperor's Palaces on the other side of the Palatine Hill. The row of low brick walls next to the concrete looks like the ruins of a long portico, or perhaps a row of shops? Any info gratefully received. – Ed.
2. The Saepta Julia was located in the Campus Martius alongside the Pantheon, where part of its wall can still be seen. It was a four-sided portico built around a 300 x 95 m open space used for citizens to gather. The little Piazza della Minerva, with its Egyptian obelisk atop Bernini's elephant was built inside its east wall. – Ed.

Heritage Award from IMechE for the Concorde SST

From the Editor

The President of the Institution of Mechanical Engineers, UK, presented the award to *Concorde 101* at a ceremony held at the Imperial War Museum Duxford on 30th April 2014.[1] See the citation below:

Concorde – BAC Aérospatiale
Powered by four Rolls-Royce Olympus engines with afterburners, this was the first supersonic transport to enter service and pioneered the use of fly-by-wire in an airliner. Concorde 101 (G-AXDN) is the British pre-production version. She reached Mach 2.23 (1,450 mph) in April 1974 and holds the speed record for the fleet.

My interest in supersonic transport aeroplanes is a purely visual one, with an element of awe at their extraordinary capabilities, and envy of those who flew those wonderful birds. In June 1972 *Concorde* was visiting Melbourne on a sales demonstration tour, and was on display at Melbourne (Tullamarine) Airport for a couple of days. This was a must see, so very early one freezing cold and foggy morning we set out for Tullamarine with the three young kids in tow. I can still see the five of us, lined up against a chain wire fence as dawn came and the mist slowly rose, to gradually reveal *Concorde* in all her glory, with her beak angled down in the signature landing and take-off position. We couldn't stand staring for very long, because we all had to be back the other side of town for work and school, but I still remember it clearly, and so does my daughter, who was just five at the time.

BA Concorde 204 (G-BOAC) visited Melbourne in 1975. Now at Manchester Airport. Photo Eduard Mamet

That was Concorde 002 (G-BSST). She first flew on 9th April 1969, and retired in March 1976 to the Fleet Air Arm Museum at Yeovilton UK. There were twenty *Concordes* built altogether, 14 of which flew commercially. Most have been conserved, and are stored all over the place, mostly on display – five in France, one at Weybridge, Surrey, one at Manchester Airport in a "glass hangar" – one near Edinburgh, one in Barbados, one in Seattle, one in New York, NY. One made its final flight to the Smithsonian National Air & Space Museum in Virginia in 2003. I wish it had been there when we visited in 1986.[2] Only two are missing from the collections – one was scrapped in 1994 after being used as a source of spare parts, and Concorde 203 (F-BTSC) crashed at Paris on July 25th 2000, killing 113 people. That crash was virtually the death knell for *Concorde* as a commercial airliner. The last few still flying in 2000 were retired by the end of 2003.

Concorde 101 (G-AXDN) in the hangar at Duxford Aviation Museum. Photo - Keld Fenwick

It is quite extraordinary that so many of the planes survived – a sign of the remarkably important place they hold in aviation history – the first commercial supersonic transport planes, some of which still hold current air-speed records. *Concorde* was graceful and beautiful in flight and on the ground. She represents an historic co-operation between British and French industry. She is one of the best known and most loved aeroplanes ever built, even though most of us could never afford to fly in her. *Concorde*'s romantic image holds despite the fact that they were always extremely expensive to build and maintain and fly. With a narrow body (four seats across) and carrying only 100 or so passengers, they could never compete with more recent wide-bodied airliners, even if they could fly twice as fast.

The Cockpit of G-AXDN. The Flight Engineer's station is out of view to the right. Photo - Keld Fenwick

Our UK reporter, Keld Fenwick, MIMechE(Ret'd) and former pilot, attended the presentation and took the photos of G-AXDN at Duxford. He noted that the very ordinary looking instrument panel would be familiar to just about any airline pilot. He was told that, during testing, the fuselage contained some 12 tons of computing and recording equipment – the data on which, these days, could fit on one laptop. A strong point was made in the speeches that the *Olympus* engines in the *Concorde* were Rolls-Royce engines. Keld says: *They were, but only second hand, so to speak. The Olympus started life in 1946 when Bristol submitted designs to the Ministry of Supply in answer to a tender for an engine of about 8000 lbs (35.59 kN) thrust. The design was then unique since it was the first time the two-spool concept had been proposed. This layout uses two independent compressors driven by two independent turbines giving the engine high compression ratios (important for fuel economy) and great flexibility (necessary for an aircraft flying subsonic and supersonic). The engine became a Rolls-Royce engine when Rolls was amalgamated with Bristol.*

1 See: http://www.imeche.org/news/institution/Cambridgeshires_Concorde_101_presented_with_prestigious_engineering_accolade

2 A short history of each of the twenty planes is at: http://en.wikipedia.org/wiki/Concorde_aircraft_histories.

Connections

Places to Go, Things to See, Websites to Explore & Things to Read

Engineering Heritage Construction History Congress, Chicago, 3-7 June, 2015

The Congress is hosted by the Construction History Society of America. This will be the first time the Congress will be held outside Europe, following the four previous events hosted by Madrid (2003), Cambridge (2006), Cottbus (2009) and Paris (2012).

EHA received a Call for Papers for this Congress – unfortunately abstracts were due on 15th June, too late for this issue of the magazine. However, some readers may be interested in attending. More info is available at:

www.5icch.org

The 19th International Course on Stone Conservation will be held from 15th April to 3rd July 2015 at ICCROM, Rome, Italy.

The ICCROM Stone Course was created in 1976. The 19th course, which will take place in Rome in 2015, reflects advances in practice, science, and technology, including the integration of practical methodologies for stone conservation on sites, buildings and structures. A wealth of information about this famous course is on the ICCROM website – see:

http://www.iccrom.org/nineteenth-international-course-on-stone-conservation/

Partners in the course are the Getty Conservation Institute and the Non-Catholic (ie. English) Cemetery in Rome. One caution though – the Application deadline is **1st August 2014**. You have no time to waste.

Some apps or websites you might find interesting.

MuseumVictoria Tours: Walk Through History App includes a Spotswood Industrial Heritage Walk. Go to www.museumvictoria.com.au/dicoverycentre/

From Glenda Graham – The Architecture of Kowloon Walled City at: www.archdaily.com/493900. Where were the structural engineers?

And another one from Glenda – Chinese Company 3D prints 10 recycled concrete houses. What ? See it at: www.designboom.com/technology/3d-printed-houses-in-24-hours-04-24-2014/

From a mech.eng friend in Sydney: www.bangshift.com/bangshiftxl/video-showing-rolls-royce-merlin-engines-built-amazing/

4th Australasian Engineering Heritage Conference, Lincoln Uni, Christchurch, NZ, 24-26 Nov 2014
IPENZ Centenary – Prosperity Through Ingenuity
The New Zealand Engineering Story

"The conference theme, 'Engineering, Heritage and Nature: Finding the Right Balance,' and the Christchurch location, make this year's conference especially topical and relevant with the city being three years into its post-earthquake recovery process. The conference will provide a unique opportunity to hear from practitioners working in Christchurch, but also has scope for other topics about the interaction between engineering, heritage and nature."

There will be a Pre-conference Tour from 20th to 23rd of November. Sooner or later there should be more information on the IPENZ website: www.ipenz.org.nz. Until then, try emailing eventsmanager@ipenz.org.nz.

2nd International Conference on Defence Sites, Heritage & Future, 17th – 19th September 2014, Arsenale di Venezia, Venice, Italy.

Following the success of the first conference held in Portsmouth, UK in 2012, the conference series launched by the Wessex Institute of Technology is co-organised on this occasion with the University IUAV and the Arsenale di Venezia Spa, Italy. A few of the possible conference topics include: military heritage history; defence tourism; castles & fortresses; transition from military to civilian life; economic analysis. The conference website is at: http://www.wessex.ac.uk/14-conferences/defence-heritage-2014.html

This site purports to be a call for papers, which time must be long past – but it does have tons of information about place, registering etc.

And in case you missed the announcement in the EA mag, here is some more on the subject of military history.

In 2012, as part of the 110th birthday celebrations of the Corps of Royal Australian Engineers, the RAE Foundation launched a website –

http://www.raefoundation.org.au

The Foundation is a charitable not-for-profit organisation with objectives including maintaining Australia's military engineering heritage and *"providing heritage grants to individuals or organisations to research and produce military engineering related heritage documents."*

The Foundation has previously assisted in publication of Vol.4 of the RAE Corps History, and the 1st Field Squadron History.