

EHA



ENGINEERING HERITAGE AUSTRALIA



Engineering Heritage Australia Magazine

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Cover Images:

Front – Former Killawarra Bridge nr Wingham.
Back – Former Duffs Bridge nr Wingham.

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.

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Editorial

This issue has been somewhat of a challenge, as I tried to incorporate the suggestions of several readers. One comment, that the standard 2-column format was difficult to read on small screens, has led me to attempt breaking up the pages horizontally. This couldn't be achieved on every page, but I hope that reader finds some improvement. Other suggestions, such as larger images and/or larger print, could only be achieved by pretty well doubling the number of pages for some stories. Maybe next time. At least text and images can be expanded on screen!

The Killawarra and Duffs Bridges rather cramped photo essay is going to be part of a much longer series of stories about lost (and occasionally rescued) industrial and engineering heritage I have worked on or lobbied for or just visited and photographed over about 50 years. I hope I can give them more room. I would welcome similar stories from readers.

Keith Baker's piece on the pre-conference tours took me back to the 1980s and Forbes in central-west NSW where I last saw and photographed the Abernethy Stone Lathe lying in bits and pieces spread around a paddock on the edge of town. At the time I tried to organise the Army to take it back to its original home in Sydney, to no avail. I hope to have a story/photo essay about its rescue and restoration in a later issue.

The *City of Adelaide* story follows on from the story in the December issue. A satisfactory chapter ending in the ship's history.

The Conference papers are subject to strict copyright, but I hope to be able to print extracts or stories from some of them – sometime. However, you can look most of them up online yourselves. One of the subjects of the 3D Laser Scanning paper was a part of my past education. The Victorian era facade stuck on the 1930s Old Commerce Building at Melb. Uni was always a popular exercise in architectural rendering – you could stand back from it. And then years later, in Surveying, it became a standard exercise in photogrammetry. Now it's an exercise in 3D Laser scanning. Everything old is new again!

And if you would like to know where I am going next – I point you to my brother's favourite road sign in Avignon.

The Editor

Photo - Peter Haughton



Connections

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

From the Newcomen Society, UK.

In the 350th Anniversary year of the birth of Thomas Newcomen the Society's Summer Meeting, 14th – 18th July, now open for booking, will be exploring some of the M4 corridor, broadly from Swindon to Bristol and, together with traditional visits to historical sites of engineering interest, we will be including a significant number of modern production and research sites which we hope will generate interest. Modern industrial sites are very difficult to get into these days but with the help of some special contacts we have managed to secure some exciting visits. Read full details and book online here:

http://www.heritageofindustry.co.uk/Longer%20Tours/2014_Newcomen/NewcomenSummerMeeting.html

Non-members are welcome.

The Newcomen Society notice was sent by Bill Barksfield of *Heritage of Industry – Journeys into the Industrial Past*. Their website: <http://www.heritageofindustry.co.uk/index.htm> has a host of tours to check out. I note at the bottom of one list *EHA Conference & Tours, Newcastle, NSW 3rd - 9th December 2015*. Early notice indeed – the first I have seen. I am sure the organisers will keep us aware of developments.

Ken McInnes draws our attention to another UK website: <http://www.engineering-timelines.com/> – an interesting place with an eclectic mixture of engineering and

industrial topics, modern and ancient and in-between – mostly British. Worth a look.

From Australia ICOMOS

This notice is old news – but you may not have seen it. The *Conservation Plan* by James Semple Kerr, 7th edition 2013, is now available for free download from:

<http://australia.icomos.org/publications/the-conservation-plan/>
The *Conservation Plan* was first published by the National Trust of Australia (NSW) in 1982.

This document has been well used by heritage and other practitioners in Australia and has found world-wide application. It outlines the logical processes of the Burra Charter and how to prepare a conservation plan so that changes to heritage places may be managed appropriately.

Now, in 2013, Dr Kerr has generously allowed Australia ICOMOS to provide this 7th edition version of the *Conservation Plan* as a free-of-charge download. Australia ICOMOS is delighted to be able to make this publication more readily available, both nationally and internationally.

Another one from Ken McInnes – and an initiative of Engineering Heritage Victoria – is the digitisation of the *Proceedings of the Victorian Institute of Engineers*, from 1883 to 1948. These are now available for perusal at:

http://dtl.unimelb.edu.au/R/?func=collections&collection_id=8166

Ken says – Have fun!

From the EHA Chair

Welcome to the second issue of Engineering Heritage Magazine and the first for 2014. On the first of January I took over from John Heathers as Chair of Engineering Heritage Australia, although I am not new to the role after having a previous term as chair in 2005-6. Thanks John for your contribution in leading the team and in keeping members informed through a regular newsletter over the past two years. With recent Board agreement, I will provide a regular column in the Magazine and will not be continuing the newsletter since the Magazine will be available quarterly to all EHA members and to a wider audience.

2013 has been an exciting year and 2014 promises to be even busier. Highlights of 2013 for a number of members included joining with the Newcomen Society in Manchester to visit the cradle of the industrial revolution, followed by the National Engineering Heritage Conference in Canberra and the associated pre-conference tour in the ACT and Southern NSW. Reports on these events will be covered elsewhere in the Magazine.

A further highlight for me while in the UK was to meet with the Institution of Civil Engineers Panel on Historic Engineering Works and witness the international recognition of the Titan Crane at Clydebank, Scotland, as reported in the first edition of the Magazine.

The production of the new bigger and more frequent Magazine was in itself a highlight, along with the heritage awards at the end of the year. These included the John Monash Medal awarded to Owen Peake at the Engineers Australia AGM, and the Colin Crisp Awards presented at the Canberra conference dinner. The first to Peter Spratt in the project section, for his vibration monitoring and analysis of the safe loading of the historic Richmond Bridge in Tasmania, and the second, in the publications section, to the Canberra Division, jointly with the author (myself), of *A Century of Canberra Engineering*.

With the Engineers Australia Colleges and other special interest groups, EHA has been faced with some administrative changes within our parent body Engineers Australia, resulting in tighter rules regarding Board membership from 2014 onwards. This has meant that Division representatives have set terms of office and the Board is limited to one elected representative per Division and an executive of three, making a total of 12 members.

This led, among other things, in the retirement from the Board of Bill Jordan after some twenty years of active service, which included editing the former Engineering Heritage News and chairing the heritage recognition committee and National Committee as it was then known. Ben Johnston, the former young engineers representative, was elected to the position of Deputy Chair, where he now fills one of the executive positions.

We have much to look forward to in 2014 with a proposed solid contribution to site visits and heritage interpretation associated with the Engineers Australia International Convention to be held in Melbourne in November, plus our ongoing programs of heritage

recognition, oral history, awards, and support for the IPENZ heritage conference in Christchurch.

During the year we will be issuing an updated version of our Engineering Heritage and Conservation Guidelines which are aimed at strengthening the understanding and participation of engineers in conservation of places, in line with the Australia ICOMOS Burra Charter, as well as the more specialised treatment of movable heritage and operating machinery. This will be coupled with the progressive development of training material to encourage engineers to take a more active role in heritage management.

We will be consulting with State and Federal heritage authorities and heritage practitioners to see how this entry level training in heritage, for otherwise experienced engineers, might be best implemented through working with partners (architects, planners, historians) in the heritage field. It is my hope and expectation that this initiative might progress to bring about a greater demand for and supply of formally accredited Heritage Conservation Engineers.

I aim to keep our readers informed on how Engineering Heritage Australia progresses over the next two years. There should be plenty to report on as we review our activities and develop enhanced approaches to the recognition of engineering heritage and conservation of the heritage works, places and objects that have been contributed to society by engineers.

At its November meeting the Engineering Heritage Australia Board moved to apply for Institutional Membership of Australia ICOMOS. A number of members of EHA have full membership of ICOMOS but the Board considered that stronger organisational links would be beneficial. Australia ICOMOS Inc. is the national chapter of ICOMOS (International Council on Monuments and Sites), an international non-government organisation primarily concerned with the philosophy, terminology, methodology and techniques of cultural heritage conservation.

To be eligible for Institutional Membership, an organisation must be concerned with the conservation, protection, restoration, rehabilitation, enhancement or animation of historical monuments, groups of buildings and sites. It must also have demonstrated knowledge and support of the *Burra Charter* and signed a copy of the Ethical Commitment Statement for ICOMOS Members.

The *Burra Charter* and its accompanying guidelines are considered the best practice standard for cultural heritage management in Australia. It is one of the key reference documents in EHA's Conservation and Management Guidelines, and its principles are followed in assessing significance for places listed under our Heritage Recognition Program, in which nearly 200 engineering works have been recognised throughout Australia.

*Keith Baker FIEAust, CPEng, M.ICOMOS
Chair Engineering Heritage Australia*

Engineering Heritage Conference, Canberra, 2013

Pre-Conference Tours



For three November days in the week preceding the 2013 National Engineering Heritage Conference in Canberra, 20 people from New Zealand and the eastern states of Australia enjoyed a bus tour around southern New South Wales exploring where Canberra might have been, interspersed with items of engineering heritage. The Tour was led by Robert Breen, Engineering Heritage Canberra secretary, with expert local guides and entertaining commentary from historian Dr David Headon.

On the fourth day EHC Canberra chair Lyndon Tilbrook led a local tour within the real Australian Capital Territory, covering the Mount Stromlo Observatory, the expanded Cotter Dam and Pumping Station and the Tidbinbilla Deep Space Tracking Station. The theme of the conference and the tours coincided with the Canberra's centenary in 2013 as the National Capital.

The potential capital sites visited included Lake George, Dalgety on the Snowy River and Bombala with its proposed port of Eden and its suggested Government House at *Burnima* Homestead.

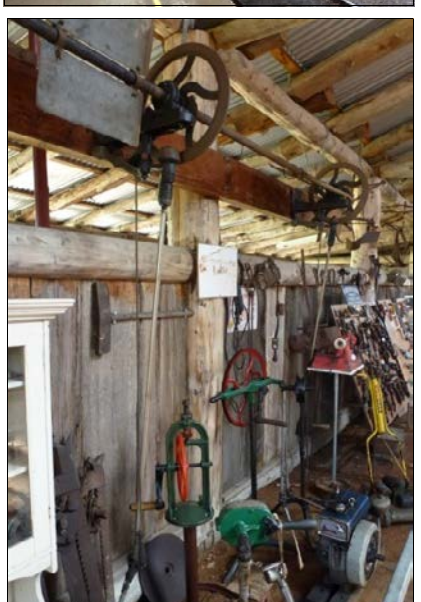
The engineering heritage sites visited: covered the granite quarry for the Sydney Harbour Bridge at Moruya along with an 1881 Abernethy stone lathe; witnessed the opening of two steel bridges (a lift span at Batemans Bay and a bascule at Narooma); inspected two timber truss bridges (a deteriorating McDonald truss bridge at Cathcart and an upgraded Allen Truss bridge at Tharwa); plus an 1888 iron lattice McDonald truss bridge at Dalgety.

Collections included the Killer Whale Museum at Eden, farm machinery at Bombala and the *Burnima* Homestead grounds, the Snowy Hydro Discovery Centre at Cooma and the Snowy Scheme Museum at Adaminaby.

While at Cooma the participants also visited the Southern Cloud plane crash memorial, were guided to the nearby rock bolting test site and had a short trip on the historic rail motor (known as the tin hare) at Cooma. In spite of Rob's best planning, that part of the tour was cut short by the first timber culvert on the line being burned by vandals or careless campers a day earlier.

The two guided tours provided a great introduction to a number of the papers at the conference.

Keith Baker, Chair, EHA



Photos – Clockwise from left:
 Detail of the bascule bridge at Narooma; Counterweight on the bascule bridge at Narooma:
 1881 Abernethy stone lathe at Moruya; May Bros stripper harvester at Burnima Moruya:
 Deep Space Station 46 at the ACT; Lifting bridge open at Bateman's Bay:
 McDonald Truss Bridge at Crankies Plain NSW:
 The Pump Room at the Cotter Pumping Station, ACT:
 Earth Mover at the Snowy Mountains Scheme museum;
 The Tin Hare at the Station Museum, Cooma:
 Part of the Engine & Machinery Museum at Bombala.

Photos from Keith Baker

Engineering Heritage Conference, Canberra, 2013

Papers from the Conference – an Overview

Canberra 100

Building the Capital, Building the Nation.

The 17th National Engineering Heritage Conference in Canberra was held in the new National Portrait Gallery, over a Sunday evening, plus three days, from Sunday the 17th of November through Wednesday the 20th November 2013. It was set to coincide with the centenary of the founding of Canberra.

The keynote speaker, Professor Ian Chubb AC, reflected the conference themes in the title of his speech – *The Role of Science & Engineering in National Development*. Most papers related to National Development in some way – through its history, discovery, commemoration, recognition or conservation.

It is not possible to print the conference papers in this magazine, but a list of the papers and authors in each of the named sessions is given, plus a few notes about the subjects and authors where these are available. A few papers have been selected for a slightly more comprehensive view.

Many papers are available, free to EA members, at: <http://search.informit.com.au/search;action=doSearch>

A highlight of the program was the Conference Dinner on Monday evening, held in the glamorous new reception centre of the National Arboretum, with the guest speaker being the new Director of the National War Memorial, Brendan Nelson.

The photo of Canberra in evening light was taken through the windows of the Arboretum dining room.



Photo – M. Doring

Papers from the Conference – the Program

Monday 18th November 2013

Session 1 - Shaping National Identity and Infrastructure

Princes Pier - Gateway to the nation, by Andrew McKinley, Jill Barnard & Jeremy Gronow. The pier was built [in Port Melbourne] in 1912-1915. It was closed to traffic in 1969 and allowed to deteriorate and then barricaded off in the early 1990s. In 2006 a “restoration” project began. One third of the length of the pier was reconstructed for public use and the original gatehouse was restored and opened for use in December 2011.

Shining Light on Our Sporting Nation - Floodlighting for International Cricket with particular reference to the Melbourne Cricket Ground, by Miles Pierce. The paper traces the evolution of floodlighting for night playing and colour television broadcasting of cricket, and subsequently other sports, at the Melbourne Cricket Ground.

Thermal Power Station Heritage in Australia, by Owen Peake. Owen Peake is an Honorary Member of Engineers Australia, and the 2013 winner of the Sir John Monash Medal of Engineers Australia. This paper is not available for downloading or reading.

Session 2 – Celebrating a National Centenary

The Contribution of Interstate Engineers in Establishing the National Capital, by Keith Baker.

Following Federation, Commonwealth Departments were progressively formed and staff members recruited, borrowed and developed as experience was gained in delivering new Federal functions. The paper identifies the essential contribution of engineers and allied professionals from NSW, Victoria and Tasmania in the establishment of Canberra as the seat of Commonwealth Government.

L. A. B. Wade: Footnote or Founding Father? by Greg Wood. Leslie A. B. Wade, son of an engineer and brother of NSW Premier Charles Wade, was a senior, high profile, civil engineer in the NSW Public Works Department at the turn of the 20th Century. Wade was closely involved in assessing alternative sites for the national capital. His specific role was judging the adequacy of water supplies, the overriding practical consideration in weighing the contending sites.

Papers from the Conference – the Program

Scrivener Dam - Remediation of a National Icon, by Christian Leah.

Scrivener Dam forms (or creates) Lake Burley Griffin through Canberra's Central National Area and constitutes a key landscape feature in accordance with Walter Burley Griffin's vision for the city. The dam was built from 1960 to 1964. Recently, a problem with corrosion led to a novel solution for remediation

Session 3 - International Co-operation

A Giant Leap for a Small Town – Carnarvon's Role in Australia's Contribution to the Space Race, by Mark Bush & Ian Maitland.

On the 21st of July, 1969, Neil Armstrong became the first man to walk on the moon. Australia's national effort to support the NASA Gemini and Apollo programs, featuring tracking and communication facilities at several locations across the country, was crucial to the success of the venture. Carnarvon played an important role. The central coast of Western Australia is almost diametrically opposite the launch site at Cape Canaveral. The highest point in the orbit of a NASA satellite occurs over Carnarvon, making the tracking station (NASA Carnarvon) the first that could confirm the orbit of a newly launched object. Communications between the tracking station and Mission Control in Houston were provided by a nearby OTC station (OTC Carnarvon). NASA Carnarvon was also the first tracking station that could welcome the returning craft back into an atmospheric re-entry trajectory for splash-down in the Pacific Ocean. The story of NASA and OTC in Carnarvon is one of technological and engineering achievement of the highest order. It is also a story of the social impact on a small rural town of the influx of an urban high-tech workforce who contributed to and blended in well with the community.

Apollo - Canberra's Vital Role by John Saxon. This paper is not available for downloading or reading.

Tuesday 19th November 2013

Session 4 – Conserving and Interpreting Engineering Collections

Collection, Conservation & Interpretation at the Australian War Memorial. Keynote address by George Bailey.

This paper is not available for downloading or reading.

The Plight of Engineering Heritage in Australian Museums by Alison Wain. Engineering heritage is often left to rot in unloved corners of museums, with little or no interpretation or maintenance. This is influenced partly by the money, space and other resources required to display it more adequately, but even more by the decisions made by museum managers about where to invest scarce resources. To raise the profile and funding of engineering heritage it is necessary to better engage both visitors and museum managers, to help them realise the potential of engineering objects as heritage displays. This paper discusses the results of research into visitors' needs and preferences when visiting engineering heritage, with a view to creating displays that are more attractive to a wider range of audiences.

Session 5 - Engineering Heritage Assessment

Movable Span Bridges of NSW – a new classification system, by Ian Berger, D. Healy and Mark Tilley. NSW Roads & Maritime Services manages 26 movable span bridges of which 11 are still operational. These bridges were the subject of a recent study by RMS and GHD Newcastle which focussed on the components of each bridge for the purposes of detailed heritage assessment, conservation and operational enhancement. The majority of bridges within the study can be broadly categorized as either bascule or vertical lift type. Detailed assessment has led to the recognition of particular subtypes within these groupings. The paper explores the international origins of movable span bridges and details the defining characteristics of these subtypes and suggests a new naming convention for each.

Is Big Necessarily Better? The "Discovery" of Highly Significant Small Bridges, by Bill Jordan & Rosemary Melville. In the history of heritage recognition in Australia, large bridges, with large dams, have led the pack when lists of works of engineering heritage significance have been prepared. There have only been rare exceptions where any recognition has been given to a small bridge – such as the first small composite steel and concrete bridge near Hobart. Work on the conservation of a small bridge in the Hunter Valley of NSW, which had hitherto received little heritage recognition, uncovered a very early steel girder NSW road bridge built at a time of government strictures on importing iron and steel, and found a fascinating story about the politics and engineering of bridges in the late 19th century.

Heritage Significance – Getting it Right, by Michael Clarke. It is important that statements of significance of heritage places are comprehensive and accurate, as they are the basis for policies and management of the places, including maintenance and conservation. If statements of significance are deficient, important values can be overlooked during conservation work and unacceptable damage or loss can result. A case studied is that of a significant set of stairs attached to the 1898 Morpeth Bridge, which were demolished during upgrading and conservation work on the bridge in 2008.

Session 6 - Forgotten Heroes; and One Remembered

Felix Caldwell – the man and his [nearly] forgotten engineering, by Jim Longworth.

This paper examines the working life of the pioneering Australian engineer Felix Caldwell and his engineering output. His inventions included four wheel drive and four wheel steering of farm and road tractors, and he applied internal combustion and friction drive to railway locomotives. This paper collates his range of inventions, and asks why are his innovative mechanical designs largely unknown today?

Papers from the Conference – the Program

Francis Bell – a Pioneer in Metal Truss Bridges, Overlooked by History, by Ken McInnes. Francis Bell CE MInstCE (c1821-1879) deserves greater recognition for his influence on the earliest use of metal truss bridges both in Ireland, and in Australia after his emigration in 1853. His life, his engineering career and his engineering work in Australia, spanned the colonies of Victoria and New South Wales, across a wide field of civil engineering – through the design, construction and operation of early colonial railways, through harbour and river works, through colonial water supplies, and through the construction of many of the earliest metal truss bridges in both colonies.

How the West was Won (The Manufacture of Agricultural Machinery in the Western Suburbs of Melbourne), by Matthew Churchward. Matthew is the Deputy Head of the Humanities Department at the Museum of Victoria. He has done considerable work with the H.V. McKay Massey Harris collection held at the Museum. The Editor has not seen this paper, and it is not at present available for downloading or reading.

Session 7 - Celebrating, Interpreting & Recording

A More Engaging Way to Drive the Convict Trail, by Daniel Woo. The Convict Trail refers to the Great North Road in New South Wales. It is the 240 km stretch of roadway that was built with convict labour during the period 1826 and 1836. It was the means of passage overland for the populations of Sydney and Parramatta to venture northward to Newcastle and the upper Hunter Valley. A new audio driving tour 'app', designed for hands free and eye free use in the car, has been created to provide listeners with an interpretation of a section of the Convict Trail between Bucketty and Wollombi, NSW.

Celebrating VicRoads Centenary 1913 to 2013 – No budget? No worries! A guide to celebrating heritage in an innovative and affordable way, by Mary Parker. VicRoads had the challenging and exciting role of celebrating an important milestone in its life, during a time of uncertainty about the future – with very little budget. This paper explains how heritage can be celebrated using innovative collaborations with the community and private sectors. It also demonstrates how to use existing social media channels to reach new audiences.

Engineering for Lake Ginninderra in the ACT – A Technical Memoir, by Geoff Henkel. The author has been involved in the design of a number of dams and spillways and has been responsible for the original dam design development of Lake Ginninderra in Canberra and its recent spillway upgrade, working either for the development authority (National Capital Development Commission) or as a consultant. This paper outlines the engineering design and later upgrading of Canberra's second lake, built in the 1970s as a multi-purpose facility and centrepiece for Belconnen new town and as a major aesthetic and recreational lake waterscape.

Lower Molonglo Water Treatment Facility, by Simon Webber. The Editor has not seen this paper, and it is not at present available for downloading or reading.

Wednesday 20th November 2013

Session 8 – Technology and Infrastructure Conservation

Helping Preserve and Rejuvenate our History – 3D Laser Scanning for Heritage Buildings and Structures, by Thomas Werner. Heritage buildings and structures under redevelopment or rejuvenation require detailed information for visualisation and decision making. This information – used by Engineers, Architects and Builders for reinforcement, redesign and preservation requirements – is critical for ensuring preservation and rejuvenation works are successful. High-Definition Surveying is an established solution tool for recording Heritage Buildings, Facades and Structures (such as Masonry Arch Bridges) due to its ability to comprehensively record, store and supply accurate as-built deliverables for use on projects using Terrestrial 3D Laser Scanning.

A Concise History of Tharwa Bridge, by Brian Pearson and Ray Wedgwood. The bridge over the Murrumbidgee River at Tharwa, opened in 1895, consists of four spans of timber Allan Trusses, each 27.4m (90ft) span, flanked by approach spans, originally of timber, but later of reinforced concrete and steel. The history of the site and the bridge is given, the development and contribution by the authors to the Conservation Management Plan is outlined, the rationale for the heritage sensitive strengthening of the trusses is explained and the restoration and conservation works during 2008 to 2011 are described.

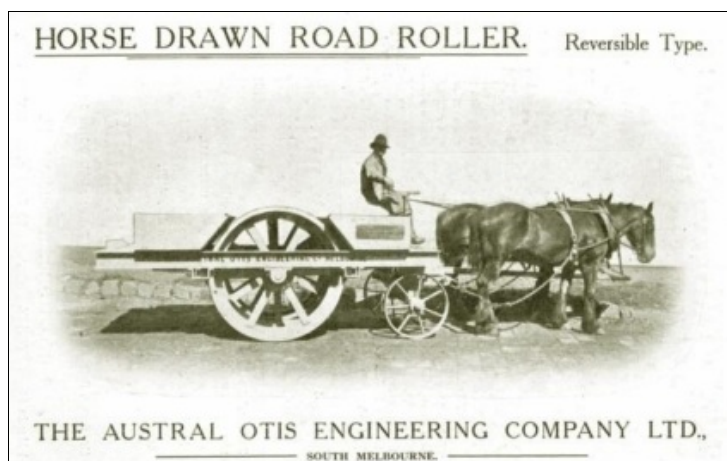
Preserving Australia's Heritage Whilst Providing Fire Safety, by Chris Gildersleeve, Dr Marianne Foley and Mr Kelvin Bong. There is growing awareness of the need to preserve our heritage buildings, at the same time as an increased focus on health and safety and the performance of buildings. Heritage buildings do not meet provisions of the current building code (BCA) for fire safety, equitable access, or sustainability as currently measured. But does this mean they are not acceptable for use? Buildings will only be kept and maintained if they can continue to be used. Assessing the existing performance of heritage buildings against requirements of the BCA provides one way to test their acceptability and identify the need for upgrades. This approach is more flexible than using prescriptive provisions and allows greater preservation of heritage fabric. However many heritage buildings are not close to meeting current performance requirements and an upgrade to achieve this level of safety would result in an unacceptable loss of heritage value. For these buildings a risk based approach to evaluating fire safety offers a more useful approach. Such an assessment considers all aspects of fire safety including the effect of management or use on the likelihood of ignition and fire spread, and potential for effective fire intervention, rather than the standard fire engineering approach that assumes there will be a fire and then addresses the consequences. This paper will consider various approaches to upgrading fire safety in heritage buildings, including examples such as the Sydney Opera House and Parliament House in Brisbane.

Papers from the Conference – the Program

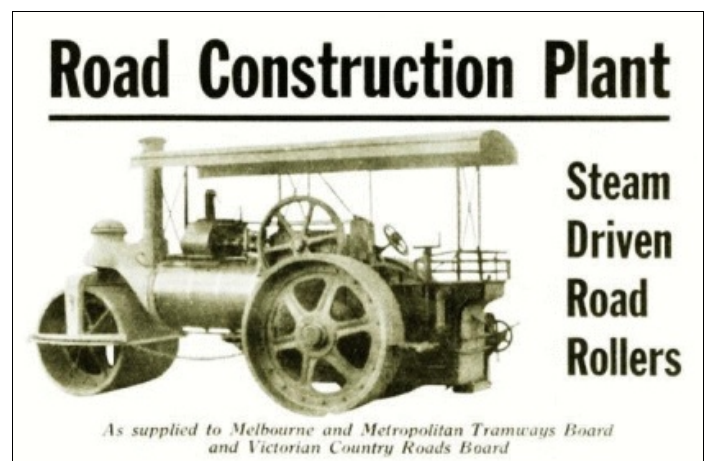
Session 9 - Industrial Heritage and Conservation Issues

- Losing Australia's Industrial Heritage*, by Ian Wills. Manufacturing was the heart of the Industrial Revolution, an event that has been described as “the most significant engine for change in human history”. It has had global impact including in Australia but, despite its economic and social impact on Australia, manufacturing industry is notably under-represented in Australian heritage lists. This paper draws on the history of Sydney's Cockatoo Island Dockyard to argue that this under-representation, and the treatment of manufacturing sites, is a consequence of a combination of factors including the origins of the heritage industry itself, a bias against the kind of knowledge manufacturing industry represents and a distorted view of its role in Australia. These reasons are then developed into arguments for why our manufacturing heritage should be more highly valued and conserved, because its loss impoverishes our understanding of the recent past, perpetuates a millennium-old bias and distorts the history of Australia and our understanding of what it is to be Australian. We may not recognise it, but manufacturing industry is an important part of what has made us what we are as a nation and is significant as engineering heritage.
- Sugar Australia - 140 Years of Sugar Manufacturing at the Yarraville Refinery*, by Andre Jemison and G. Ritchie. This paper presents a short history of the Colonial Sugar Refinery (CSR) company in Australia and celebrates the heritage value of the Yarraville refinery and structures from the three centuries in which it has operated, to today where it still remains as a competitive manufacturing facility. The paper further discusses Sugar Australia's approach to, and challenges from, continuous improvement at the 140 year old refinery to build a sustainable business for the future while respecting heritage values from the past.
- Paving the Way – Steam Roller Manufacture in Victoria 1890 to 1940*, by Peter Evans. In newly-Federated Australia the focus of civil engineering turned gradually away from railways and towards roads. In 1908 J. M. and H. E. Coane published *Australasian Roads*, the first truly Australian text on road construction. This book ran to a number of editions and was updated and heavily revised by B. M. Coutie in 1927. A theme of every edition was the introduction of mechanisation in road making. As William Calder (M.Inst.C.E.) wrote in the preface to the fourth edition: ... *we are now in the midst of a new era in Road Transportation – an era as far reaching in its effects, commercially and socially, as that brought about by the invention of the steam engine*. Protective measures introduced by the new Commonwealth government in 1907 encouraged the manufacture of local equipment to build new roads for the young nation. This paper examines steam roller manufacture in Victoria from 1890 to 1940, with up to 36 steam rollers built by five Victorian firms during this period. These steam rollers were used by the Victorian Country Roads Board as well as Shires and Cities throughout Victoria in the creation and maintenance of a modern road network. (One of these Victorian-built steam rollers was purchased by the Department of Home Affairs in 1913 specifically for the construction of the Federal Capital, and is preserved there today). The five firms concerned were the Phoenix Foundry of Ballarat, Austral Otis of South Melbourne, Jaques Brothers of Richmond, Thompsons of Castlemaine, and Cowley's Eureka Ironworks of Ballarat. Of these, Cowley's produced almost half of the total output of Victorian-built steam rollers. In a revolution paralleling that of the civil engineers as they turned their focus from railways to roads, these mechanical engineering firms were turning their focus from the support of gold mining to general engineering. The paper will give a brief history of each firm with the emphasis on Cowley's as the principal producer of steam rollers in Victoria and, indeed, Australia.

Lucky Last Gets the Pictures — These two advertisements reproduced in the steamroller paper took my fancy, with their evocation of the horse-drawn Victorian era, followed by the roaring Twenties.



From Figure 1: The predecessor of the steam roller. This reversible horse-drawn roller built by Austral Otis appeared in the book by Coane et al in 1915. The fore-carriage was detachable and relieved the horses of most of the weight on their backs.



From Figure 4: Advertisement for the Thompson steam roller from Coutie's 1927 revision of Coane's *Australasian Roads*. Four Thompson rollers have survived, of which only one resides in Victoria at a machinery museum at Maldon.

The Great Ocean Road in Victoria

The World's Largest and Longest War Memorial



The Great Ocean Road winds along the south west coast of Victoria from Torquay, through Anglesea, Lorne, Apollo Bay and Port Campbell, ending 241 kilometres further west at Allansford, near Warrnambool.

It was built by ex-servicemen from the First World War, and construction started in 1918.

It was first built as a gravel road, as were all country roads and highways in those days. The road is now a fully bitumen-sealed two-lane highway.

Engineering Heritage Marker for Great Ocean Road

On 30th August last year a ceremony to recognise the engineering heritage significance of the Great Ocean Road (GOR) was held at the Great Ocean Road Arch at Eastern View, not far from Aireys Inlet. The Arch itself now has a special significance commemorating the construction of the road, but it was originally built in memory of Major W.T.B. McCormack, a past Chairman of the Country Roads Board CRB) and the Honorary Engineer of the Great Ocean Road Trust, the first construction authority for the road. The Engineers Australia marker and interpretation panel joined a collection of memorial plaques and a bronze sculpture of road workers at the Arch.

Engineering Significance of the Great Ocean Road

The Great Ocean Road is an outstanding example of how a major road was constructed over very difficult terrain largely by manual labour and with minimal use of modern mechanical equipment. It is particularly associated with two important engineers – William Calder, also a surveyor and the first chairman of the CRB, and Major W.T.B. McCormack.

Although McCormack took an interest in the work, and made engineering decisions, much of the design work devolved on to the chief engineer of the CRB – A.E. Callaway and construction engineers and surveyors J.B. Wilkie, W. Pascoe, C. Jones and J. Hassett.



Left: The Arch at Eastern View.
Photo taken in the early 1950s.
Source - GOR Authority, 1984.

Right: The ex-soldier workmen sculpture at Eastern View beside the Arch.
Photo - Owen Peake, 2009.



Great Ocean Road – the History of its Development

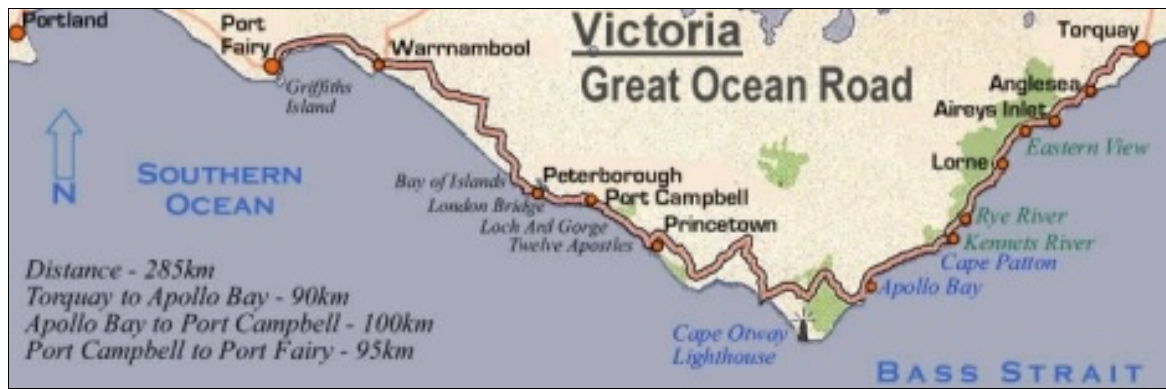
A number of settlements spread down the south-west coast of Victoria following the establishment of Geelong in 1838. These settlements along the coast were serviced either by ships or by tracks going inland to what is now the Princes Highway or later to railway stations. There was no connection between these coastal settlements.

In 1859 an electric telegraph line from Melbourne was established. It ran to Geelong, Winchelsea then out to the coast at Moggs Creek before following a coastal route to Cape Otway. There it linked to the submarine cable to King Island and Tasmania. A bridle path along the telegraph route was well used as a track between Lorne and Apollo Bay despite being extremely challenging and dangerous.

By 1900 there was still no coastal road, despite the growth of popular holiday resorts like Anglesea and Lorne and farming communities further along the coast. In 1916 the question was asked whether ex-soldiers could be employed building special roads. The GOR was one of these, but as it was neither main road nor development road, the CRB could not finance it.

The Mayor of Geelong and other citizens set up The Great Ocean Road Trust, intending to raise £150,000 to finance the building of 100 miles of a road to link Barwon Heads with Warrnambool along the coast. The CRB would design and supervise it all for no remuneration, and employment would be offered to “*physically fit returned soldiers suitable for that class of work*”.

“The carrying out of this Scheme would provide the finest Ocean Road in the world.”



Great Ocean Road – the History of its Construction

In July 1918 the GOR Trust decided the first section of road to be built would be the 18 miles from Lorne to Cape Patton. Starting at Cape Patton, a survey party of ex-servicemen, with Warrant Officer-Engineer-Surveyor John Hassett in charge started almost immediately, but progress was slow. They reported that the first section *presents more engineering difficulties than other sections on the route, but they can all be overcome*. A year later, on September 18th 1919, the party had passed Lorne and reached Anglesea – 36 miles from the start. The Trust celebrated with a dinner at Erskine House, Lorne, and asked the Premier to give them some blocks of land that they could sell to raise funds.

A first work party of 20 men was organised to start at Lorne, heading toward Apollo Bay, but by January 1920 it was decided to abandon that route for the time being, and head from Lorne towards Geelong instead, starting in April.

Two years later in March 1922, the State Governor, Lord Stradbroke, was able to officially open the section from Lorne to Eastern View, but the Trust was seriously short of money and they set up a tollgate at Grassy Creek between the two villages – an idea that produced some money, but not enough. Over the years land sales and occasional government grants and contributions from the public raised enough money to keep the work going on a number of fronts, complemented by intermittent CRB built sections, and one private toll road between Anglesea and Aireys Inlet.

It was fourteen long years before the road was pronounced complete between Geelong and Warrnambool, and allow an official opening ceremony to happen at Lorne on November 25th 1932. The next four years brought more work to widen the road to two lanes, from Geelong to Apollo Bay, and in October 1936, the Trust transferred the care and management of the road to the CRB.



The GOR Trust gathered at Geelong in 1918.



Road to Lorne completed, March 18 1922



The Governor cuts the ribbon, March 18 1922

The Great Ocean Road as a Memorial

The Great Ocean Road is significant as a memorial dedicated to Australian servicemen who died in World War One, as shown in the bronze plaque at the Memorial Arch.

It also commemorates the labour of the 3000 World War One servicemen who returned to Australia and built the road over a period of thirteen or fourteen years, including the ex-servicemen engineers and surveyors who surveyed, designed and supervised the construction – both within and outside the CRB.

Some excerpts from the history of the GOR in the Engineering Heritage Australia nomination document give a lively picture of what it must have been like to work on the road. Selections from the text can be found on the next page. The whole document will eventually be available at: <https://www.engineersaustralia.org.au/heritageregister/search> or you can email the Editor for a copy. Unless otherwise attributed, most of the photographs in this story are taken from the nomination document.

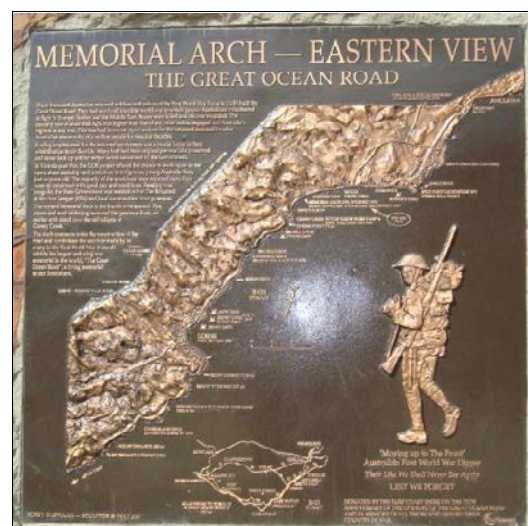


Photo - Owen Peake

What it was like to work on construction of the Great Ocean Road



Work in progress, Lorne to Apollo Bay 1919



Inspection on Big Hill, July 1931.



Rose Postcard: Mt Defiance section in the 1920s.

General Conditions:

The works were undertaken with hand tools, explosives, wheelbarrows and horses dragging scoops. Men were lowered down the cliff by using ropes tied to trees to enable charges to be set. The servicemen were paid 10 shilling and sixpence per day, approximately equivalent to the average Australian wage in 1920. This was four shillings and sixpence more than their pay whilst in service. In the early years of the project the workers were not pleased with the conditions of their employment. Some did not find the climate agreeable; others disliked the rough camping conditions and were disappointed with the low salaries, which were sometimes delivered late.

At that time [1920], the track was too narrow for vehicles to pass, and the road was only formed, not metalled [i.e. sheeted with road gravel], and the heavy rain usually caused the cliffs to slip onto the road. By 1934 the road was metalled and before that, many considered it only a fair-weather track, with heavy rain making the route impassable. Periods of torrential rains caused a number of other rock slides and road closures in the latter half of the twentieth century.

September 1919 – A camp had been set up for 20 men 1 mile (1.6 km) from the St Georges River near Lorne. Corporal G. Cooper, ex 12th Field Engineers was appointed supervisor of the returned soldiers. He had, prior to enlisting, been a foreman under the CRB and had experience of road making in France while on active service. The ex-servicemen worked a half-day on Saturdays. Each had a tent and there was a dining marquee and kitchen at the camp. A report in the *News of the Week* by Captain Chaplain Neville said that a vegetable garden had been planted near the camp. The men had lunch brought to them by their cook and hot meals are ready when they return from work.

April 1920 - In April 1920 Mr. W. J. Bridges was appointed overseer and a camp was set up at Reedy Creek. Work then proceeded from this camp towards both Lorne and Eastern View. Most of this work was arduous and required blasting to create the road. No mechanical equipment was available and all the work was done by hand. The road was 15 foot wide (4.6 m) with the passing spots every hundred yards (91 m). A 4 mile (6.4 km) section of the road cost £4,500.

May 1922 – the road was closed for improvements, including blasting rock from dangerous bends, changes to the grade etc. By the end of May more than 75 men were working on the road. By August 94 men were working on road improvements and construction of the road west of Lorne to Apollo Bay.

March 1923 – Sixty returned soldiers started work in March 1923 on the section of road between Wye River and Cape Patton, cutting a 15 foot wide (4.6 m) track along the cliffs. Their continued employment depended on what funds the Trust could raise. The State Government made £50,000 available for building Tourist Roads, The portion allocated to the GOR was used, together with £1,000 raised by the Trust, to set up a camp for 50 former soldiers at Cumberland River to work on the Lorne to Wye River section of the road.

February 1924 – a gang of 30 men started work on the Mt. Defiance section of the road. In the same year, the steamer *Casino* was stranded near Cape Patton forcing it to jettison its cargo of 500 barrels of beer and 120 cases of spirits. The ex-diggers salvaged the cargo, which resulted in a two-week drinking binge.

July 1927 – the CRB report to Parliament on the Lorne to Apollo Bay section of the road stated that the public had contributed £21,000 to the cost of the work which included 8 miles (12.9 km) of sidecutting, and 17 miles (27.4 km) of track 5 feet (1.5 m) wide. A gang of ex-soldiers was widening the grade track between Lorne and Wye River and £16,900 was needed to complete the earthworks that would allow cars to travel the 108 miles (174 km) between Melbourne and Apollo Bay via the Great Ocean Road.

1919 to 1936 – Employment was given to a total of 3,000 returned soldiers. The number employed, at any one time varied according to the finance available. The sections built by the Trust traversed very difficult terrain requiring, at times, workers to be suspended from ropes to drill holes for explosive charges. The work was largely done by pick and shovel – debris was removed by wheelbarrow or for the less steep sections by horse drawn scoops. It was not until 1923 that a grader was used and a truck donated by a Melbourne firm became available to spread metal [gravel or crushed rock] on the road.



Some recent views of the Great North Road.

Left: Around the cliffs.

Right: From the road.

Photos – Owen Peake.



The “City of Adelaide” back at Port Adelaide

The world’s oldest composite clipper ship, the *City of Adelaide* (built in 1864, with timber planking over an iron frame), has made one more journey from England to South Australia and arrived in the Port River, Adelaide, in the early hours of Monday 3rd February 2014.

Coincidentally it took 70 days to do so, equalling its fastest voyage under its own sail in 1866 when it left Plymouth on 2nd August and arrived in Port Adelaide on 11th October.

It did spend five days in port in Cape Town in 1866, but the German heavy lift ship *MV Palanpur* that carried her this time, also had to make stops along the way, calling first in Norfolk, Virginia, to load six locomotives; Cape Town, to refuel; and Port Hedland to deliver the locos.

The design of the shipping cradle and the additional sea fastenings (bracing) were severely tested on the trip south along the Western Australian coast by waves which, at times, rolled the *Palanpur* more than 20 degrees. Much of the wrapping around the ship – applied in the Netherlands as part of the quarantine preparation process – was also torn loose by winds on this leg of the voyage.

The *City of Adelaide* was given a warm welcome on the evening of its arrival by several hundred well-wishers (and one lone piper) who toasted its arrival with Coopers Ale and Villi’s pies – the same sustenance provided at the renaming ceremony at Greenwich on 18 October last year.

The sea fastenings and the shipping cradle had been welded to the deck of the *Palanpur*. Once these attachments had been released, the cradle had to be skidded across the deck on Teflon pads, using chain pulleys, to fit it between the pedestals of the cranes prior to lifting it onto its barge.

This operation is fascinating to watch as the two deck cranes thread the *City of Adelaide* between their pedestals, see: cityofadelaide.org.au/the-project/final-voyage.html. The lift was carried out on Thursday 6th February and the barge was towed into the *City of Adelaide*’s temporary home in Dock One that evening.

The City of Adelaide Preservation Trust purchased *Bradley*, the splendid green-and-gold barge late last year. Previously *Bradley* had been used as a crane platform to lift the girders of the new Port River bridges into place. These two single-leaf bascule bridges, one road and one rail, were completed in 2008 and had to be opened to allow the passage of the barge and the *City of Adelaide*.

With the *City of Adelaide* safely back at Port Adelaide, perhaps the most challenging stage is yet to come: ensuring that it is placed and presented in the best location to tell its fascinating story – not the least of which is the clever engineering which brought it here.

Richard Venus
Engineering Heritage SA



The “City of Adelaide”, on “Palanpur”, tied up at Adelaide on the evening of 3rd February 2014
Photo Richard Venus



The “City of Adelaide” being loaded onto the barge “Bradley”, 6th February 2014
Photo Peter Roberts



The “City of Adelaide” temporarily moored on its barge at Dock 1, Port Adelaide.
Photo Richard Venus

[The story of *City of Adelaide*’s earlier adventures is told in the December 2013 issue of the magazine — *Editor*.]

2000 Years of Stone Bridges in Provence

Two Australian Civil Engineers Touring in 2013

It was just chance that my brother Peter Haughton, a civil engineer (it runs in the family), and my colleague David Beauchamp, another civil engineer, both happened to be in Provence last European summer with their partners, and both sent me photos of stone arch bridges they had seen in their travels. The first, the Pont du Gard, a purely practical but also beautiful aqueduct, was built in 19 BC. The last, a decorative piece of sculpture, was built in 2013 – a span of more than 2000 years. David's comment: *It says something about the aesthetics of stone arch bridges that they have gone from being utilitarian engineering structures built to carry people, vehicles or water to becoming sculptures built only to display their graceful form.*

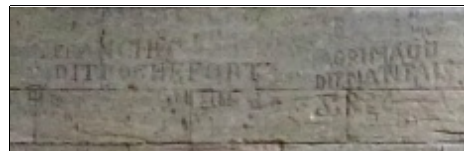
I hope you enjoy this long stretch of history *The Editor*



The Pont du Gard, a 3-level stone aqueduct crossing the Gardon River between Uzès & Nîmes. Built 19 BC for the Emperor Augustus. Photo Peter Haughton
This view of the south side of the bridge was taken from the right bank, looking north (upstream) towards the tourist centre on the left bank.
The 1743 (new) lower level & roadway is on the other (north) side of the bridge from this photo.

The Pont du Gard

The Pont du Gard is part of a 50km long aqueduct, built by the Romans to carry water from springs near the present town of Uzès to the Roman city of Nemausus (now Nîmes). It is 49 metres high and 275 metres long. The aqueduct was effective for about 400 years, but as the Roman Empire waned, and the Roman style of government decayed, so did the aqueduct, until it was silted up and unusable as another 500 years passed. Much of its length gradually disappeared, and many of its stones could probably now be found in churches and castles along its route. The lowest level of Pont du Gard however, made a convenient all weather foot crossing of the Gardon River, and it survived, partially intact.



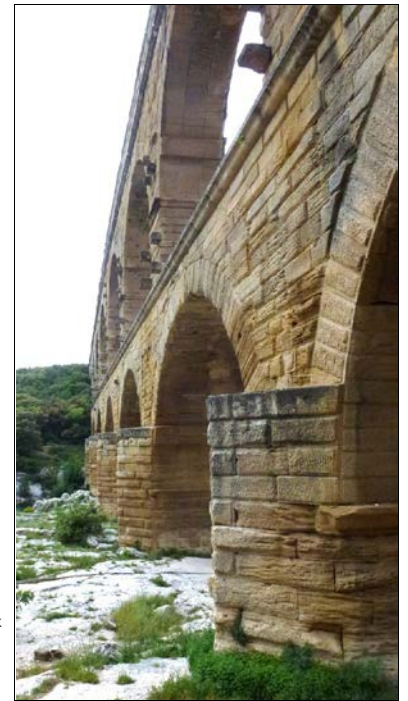
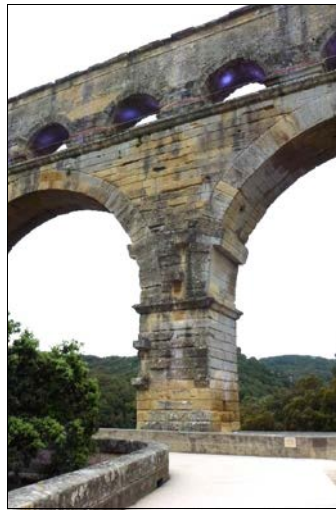
Some technical details come from: *Pont du Gard – Provence Beyond* at: <http://www.beyond.fr/sites/pontgard.html>

The full aqueduct had a gradient of 34cm/km (1/3000), descending only 17m vertically in its entire length and delivering 20,000 cubic metres (20 million litres) of water daily. It was constructed entirely without the use of mortar. The aqueduct's stones - some of which weigh up to 6 tons - are held together with iron clamps. The masonry was lifted into place by block and tackle with a massive human-powered treadmill providing the power for the winch. A complex scaffold was erected to support the aqueduct as it was being built. The face of the aqueduct still bears the mark of its construction, in the form of protruding scaffolding supports and ridges on the piers which supported the semicircular wooden frames on which the arches were constructed. It is believed to have taken about three years to build, employing between 800 and 1,000 workers.

In the (late?) 17th Century, one side of the second level piers were cut back to widen the footway – presumably to allow horses and carts to cross, but this destabilised the top levels. The width was restored in 1702, and in 1743, a whole new lower level was built against the north side of the aqueduct, forming a roadway wide enough for carriages and, until 1996, motor vehicles. The bridge was “restored” several times after 1743, as it grew to be a major tourist destination, visited by many journeyman masons, some leaving names to show they had studied there (see below left). It is now one of the great World Heritage Sites in France – a monument to Roman Engineering.



Part of a tourist sign photographed by Peter. A north-point and an arrow showing the direction of the river flow have been added.



Pont du Gard – Images by P. Houghton

Clockwise from top left:

1. North side of the bridge looking towards the right bank – the 18thC roadway & stonework show at the base level.
2. Roman stonework detail in the upper level seen from the entrance to the 18thC roadway – left bank.
3. South side of bridge looking NW to the left bank – shows Roman stonework in the base level.
4. (Left) Underneath an arch – shows south (old) Roman stonework at left, & north (18thC) stonework at right. Visiting masons have carved their names in the 18thC stones.

From Roman Gaul to Medieval France

RIGHT: *The Medieval bridge of Vins-sur-Caramy is called the "Pont Romain", although it was built in the 14th-15th centuries. A long stone bridge with three wide arches, it crosses the Caramy at the bottom of a wide dam spillway, at the south edge of the village. A low "dos d'âne" (donkey-back) hump for each of the 3 arches, curved roadway and side "garages" give the bridge an interesting and graceful form.* Extract From: *Provence Beyond*

<http://www.beyond.fr/sites/vins-sur-caramy-bridge.html>



Pont Romain at Vins surCaramy

Photo – David Beauchamp

LEFT: Stone arch bridge over the Argens River south of Correns. Taken from the east bank, looking downstream.



Photo – David Beauchamp

RIGHT: The Saint Nicolas-de-Compagnac bridge at Saint Anastasie crosses the Gardon River between Nîmes and Uzès, built from 1245 to 1260.



Photo – Peter Houghton

Something Old (well, mid-19th Century) & Something New The Aqueduc de Roquefavour

While in Aix-en-Provence we visited the less well known but significantly larger 19th century *Aqueduc de Roquefavour*, that is 82.65 m high and 393 m long and is said to be the world's largest stone aqueduct. It was designed and built in the same manner as the Pont du Gard – note the projecting stones to support scaffolding for each lift of stonework – but unlike the Pont du Gard, mortar was used to lay the stonework. It was designed by the 26 year old engineer Franz Mayor de Montricher to bring water from the Durance River to Marseille. Construction started in 1841 and was completed by June 1847. From *David Beauchamp*



The Aqueduc de Roquefavour

Photo – David Beauchamp

The Aqueduc de Roquefavour is an amazing 3-tier arched stone structure built in the style of the Pont du Gard, but 1800 years later, nearly $\frac{1}{3}$ longer and nearly twice as high. It is said to be the world's highest stone aqueduct. It was built to carry the Canal de Marseille over the L'Arc River on its 80km journey south from the Durance River to the city. A cholera epidemic in Marseille was the driving force for building the canal and it took 15 years starting in 1839 and finishing in 1854.

The 2007 view of the canal and the aqueduct on Google Earth is also amazing, with the green waters of the canal plunging south through a hill just before it gets to the aqueduct, narrowing into a large concrete pipe (presumably modern) along the top level and pouring out into the canal again. Follow the canal north towards its source and it winds and twists and dives through mountain ranges. 10 m³/sec of water flows through the canal and over the aqueduct, still providing two thirds of Marseille's water.

Chateau-la-Coste

From *David Beauchamp*:

At Chateau La Coste, a new chateau and winery near Le Puy Sainte Réparate in Provence, there are two small stone arch bridges designed and built by Larry Neufeld of Donegal in 2013 as art installations for the sculpture park in the grounds of the chateau. The sculpture park features works by many famous modern sculptors including Richard Serra, Tracy Emin, Alexander Calder and others.

Photo – David Beauchamp



Killawarra & Duffs Bridges in NSW – a Requiem

These two Allan Truss timber bridges once adorned the landscape near Wingham



Killawarra Bridge 1983. Photo - M Doring.

After a horror trip up the Pacific Highway to Wingham once, the next time I detoured via Bucketts Way, through Stroud & Gloucester, and came upon this amazing bridge not far from Wingham and fell in love! Killawarra Bridge was a 5-span, timber Allan Truss bridge standing on immensely tall timber trestles which march across the Manning River. It is said to have been the tallest timber bridge in the southern Hemisphere. It was opened with great pomp and ceremony on 16th October 1901. It was topped several times in enormous floods, but stood its ground until it finally fell to the wrecker's hammer c1986, having been "replaced by a boring concrete box girder thing" (See photo below).



Just north of Wingham, this pretty, rather wobbly-looking little Allan Truss bridge, in its bucolic setting, was one of my favourites. One came upon Duff's Bridge suddenly, down a steep hill and round a sharp left hand bend, and there it was – no time to change one's mind about crossing it!

It was built in 1926, after much public agitation, to replace an unreliable low-level timber girder bridge (which must have been even more exciting to come upon suddenly in the dead of night in one of those new-fangled motor-cars!).

We got Duffs classified by the National Trust in 1986, but there were already rumblings about its future. Ten years later it had these steel stiffening trusses added to the deck (see right), and it was finally replaced by a concrete bridge in 2012.



Above: Duffs Bridge over Dingo Creek, 1983
Right: The bridge reinforced, 1996. Photos - M Doring

Both these bridges were, in their time, a celebration of the Allan Truss, one of the most popular bridge designs used in provincial NSW. The Allan Truss was designed by Percy Allan (1861-1930), who was PWD's Engineer in Charge of Bridge Design (1895-1899) and PWD/DMR's Chief Engineer (1918-1927). He designed a series of standardised timber through-trusses, in single or double-lane road bridge versions, to span 60ft, 75ft, or 90ft. His trusses had timber top & bottom chords & diagonal compression members, and iron/steel rods as vertical tension members. An Allan Truss is easy & simple to repair without crippling the truss or putting the whole bridge out of action. *The Editor*



Electrolytic Zinc Co. of Australasia Ltd.

The Zinc Works is awarded Engineering Heritage Recognition.

On 23rd April 2013 the Electrolytic Zinc Works (now known as Nyrstar) in Risdon, a suburb of Hobart, was presented with an Engineering Heritage National Marker by the national president of Engineers Australia, Dr Marlene Kanga. This happened only three years short of the centenary of the founding of the Electrolytic Zinc Company of Australasia Propriety Limited, which was incorporated in April 1916. For nearly 100 years since, Electrolytic Zinc has been one of the iconic industrial ventures in Tasmania – along with the mines on the west coast, the paper mill at Burnie, and the famous hydro-electric schemes. The continuing importance of Electrolytic Zinc to Tasmania is reflected in the calibre of the guests who attended the ceremony, including: His Excellency the Governor of Tasmania, the Hon Peter Underwood, who unveiled the Marker; Tasmania's Minister for Heritage Brian Wightman; eight other members of Parliament; and 50 other guests, many of whom stayed on for a guided tour of the works after the ceremony.

Two fairly recent views of the Electrolytic Zinc works at Risdon, Tasmania. Photos from EZ documents

From the Sea – BELOW

From the Air – RIGHT



Hobart might seem an unlikely place for the production of metallic zinc on a large scale when, at that time, 1916, all the ore was mined in Broken Hill in the far inland of Australia. The first processes to concentrate the ore (to roughly 50% zinc) were carried out in Broken Hill. The concentrates were sent by train to Port Pirie in South Australia and, until WW1 started, shipped from there across the world to Europe, where metallic zinc and its byproducts were produced. At the beginning of the 20th Century, many uses for zinc in Australia were burgeoning, but it all had to be shipped all the way back to Australia from Europe – mostly from Germany.

Metallic zinc has many uses:– in die-casting; in alloys such as brass; a small percentage is rolled into sheets for roofing and flashings; but its greatest use then was probably for galvanising iron and steel. More recently, zinc oxides are used in manufacturing pharmaceuticals, paints, plastics, and a multitude of other products.

James H. Gillies

James H. Gillies was a prominent metallurgist in Broken Hill at the start of the 20th century. He believed strongly that metallic zinc should be made in Australia, where huge deposits of the raw material were being mined, rather than shipping all the ore concentrates overseas and then buying the metal back at great expense. Gillies developed an efficient method of producing zinc ore concentrates, and he patented a process for producing metallic zinc by electrolysis. In 1908 he found the ideal place for a zinc manufacturing plant near Hobart, where there was a deep port to land the concentrates shipped from Port Pirie, plenty of men needing work, and plenty of mountain water to make cheap hydroelectric power for the electrolysis. Gillies' electrolysis patent was never used, and his zinc factory never got off the ground, but he was instrumental in construction of the Great Lakes Dam and Waddamana Hydroelectric Power Station, both of which made the choice of the site at Risdon for development of the Electrolytic Zinc Company of Australasia Propriety Limited in 1916 a simple one. The start of WW1 was the catalysing agent.

Herbert William (Bert) Gepp

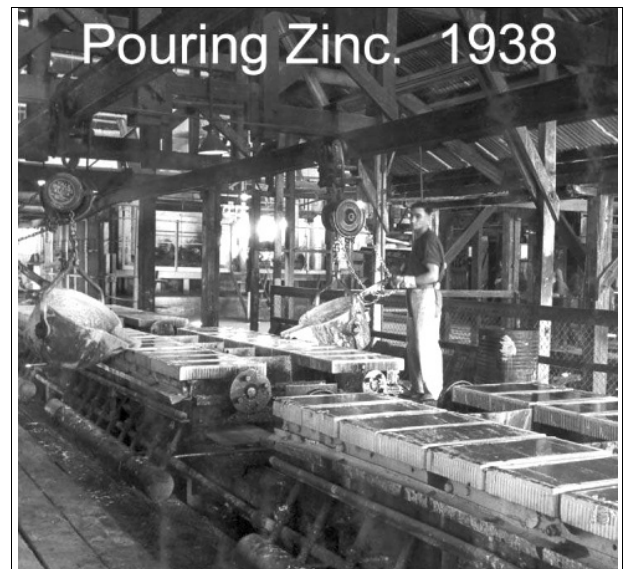
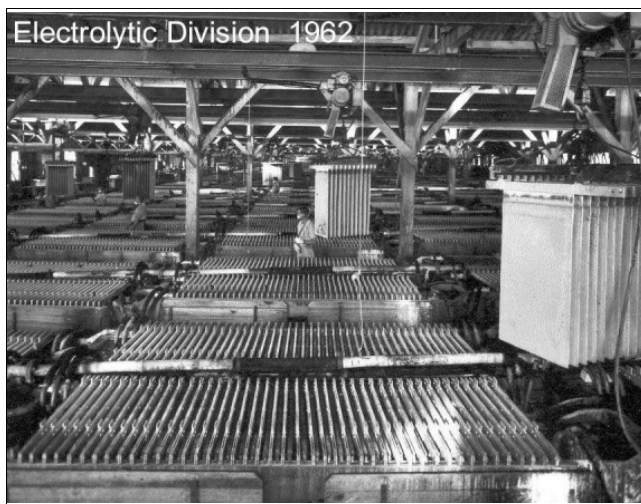
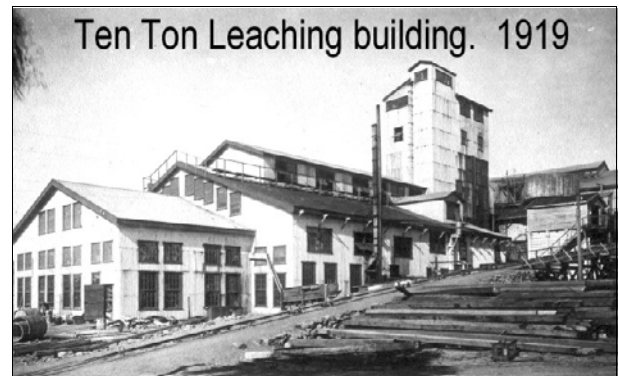
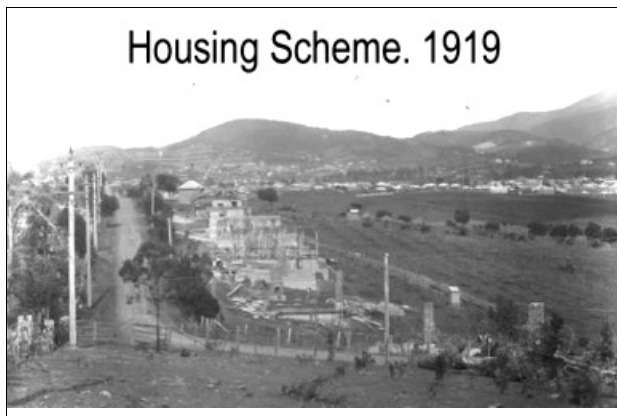
Suddenly, in 1914, there was nowhere for the ore concentrates to go, and no zinc coming back to Australia from Europe. A Broken Hill company, Amalgamated Zinc (de Bavay's) Limited, was already searching for a viable electrolytic process. In 1911, the company had sent its General Manager, Herbert W. Gepp, to Europe for a year on a *Metallurgical Mission* (his words), where he no doubt absorbed all the most up-to-date knowledge of the subject. Gepp was still the General Manager when war broke out in August 1914, but he wasted no time before enlisting and departed for *Camp at Fort Largs, South Australia, as Officer Commanding Twelfth Field Co., Royal Australian Engineers*. He was only there for a few months, before in early 1915 he was extracted from the army, apparently by the Federal Government, and sent to North America to represent the Government on munitions in Canada and the USA. It seems he continued his employment with Amalgamated Zinc throughout this period, while he *sold and arranged for delivery of nearly £2,000,000 worth of Broken Hill zinc concentrates to American companies on behalf of Broken Hill Companies*.

Construction & Operation of the Zinc Works Plant – a Very Brief Account.

Meanwhile, on Gepp's advice, Amalgamated Zinc had bought the Risdon site, signed a contract with the Tasmanian Government for cheap power and set up the Electrolytic Zinc Company, ready to start construction almost immediately. As soon as he heard the news, in July 1916 Mr Gepp engaged staff and carried out experimental work on the production of electrolytic zinc in California. By December he was back, bringing his American technical staff with him, to take over as General Manager of the Electrolytic Zinc Co. of Australasia Ltd.

After this, the company went ahead in leaps and bounds. The first industrial small-scale plant, designed to produce 113 kg (250 lb) of zinc a day, started operating on

10th March 1917. At the same time, a much larger "10-Ton" plant was under construction, and it was started up in January 1918 and ran successfully for two years until the price of zinc slumped. It was restarted in 1923 and subsequently ran almost continuously for 40 years. Its original job had been to prove the technology and demonstrate the viability of a planned, and much bigger "100-Ton" Plant. To finance the expansion for this, the company was floated, with an increase in capital to £3,000,000 in 1920. The 100-Ton unit was ready to go in November 1921. Production at the plant has steadily increased over the years until around 275,000 tonnes of zinc were produced in 2011.



I hope I haven't disappointed the chemical engineers among our readers in leaving out 99% of the technology of the Works in this account. I plead lack of space (and ignorance – as a civil/structural engineer). The technology is very well covered in *A Brief History of the Zinc Works in Hobart*, by N. Ramshaw and D. Palmer, Senior Metallurgists in the Risdon Plant. That was a paper presented at the 16th Engineering Heritage Australia Conference, Hobart, November 2011. It can be found, free for members, as a PDF on the EA website, or for purchase by non-members at a small price, at:

<http://search.informit.com.au/documentSummary;dn=895384095799768;res=IELENG>.

An illustrated version of the Brief History (as the paper was presented at the Conference – nearly all archival images, about 60 of them) can be found at: <https://www.engineersaustralia.org.au/sites/default/files/shado/ramshaw.pdf>.

The nomination document for the recognition of the Works as an Engineering Heritage National Landmark is a fairly comprehensive account of the history and operation of the Works, also by Ramshaw, and includes some of the technology plus a Heritage Assessment and a Statement of Significance. Eventually it will be available at:

<https://www.engineersaustralia.org.au/heritageregister/search>, so keep looking, or email the Editor for a copy.

Some of the Life & Works of Herbert W. Gepp – It Wasn't all Zinc!

It is evident, from my reading of the history of the Zinc Works, that Herbert Gepp was the driving force in the early development of the zinc works – he was leader, designer, project manager, supervisor, chemist and engineer, all at once. He also seems to have been almost a father figure, in his care for the welfare of his workers and their families. This care was first manifested in his work at Broken Hill¹, but he took his unusual ideas with him to Tasmania – as represented by Ramshaw & Palmer in their Short History:² *“Herbert Gepp was a man with a strong social conscience who advocated cooperation between employees and employers, and, to aid this, he set up an Insurance Society and Co-operative Store. He also set up a housing scheme in 1919 using land, purchased by the company, next to the site. Sixty homes were built on this site and rented out to employees*”

The first paragraph of Gepp's ADB³ entry mentions his birth in Adelaide (1877), education at Prince Alfred College, first job with Nobel at Deer Park, Melbourne, then Glasgow, then Melbourne again, his attendance at chemistry lectures at Melbourne University, his marriage to Jessie Hilliard in 1905 and that he had one son and four daughters. Further on, the biography covers his long career in the zinc industry, short career in the Army, a brilliant career as a public servant from 1926 to 1945, his Knighthood in 1933, and from 1931 to 1950, his association with and management of Australian Paper Manufacturers Ltd.

None of the biographical notes I have found say that, as well as chemistry, Gepp studied economics and engineering at Melbourne University during the years he worked at the Deer Park Explosives Factory. I haven't found out yet whether he graduated B.E., but there is no doubt in my mind that he was an engineer, and a very skilled one. Even his WW1 time in the army as an engineer officer bears that out.⁴



Herbert Gepp with baby Mardi up front at the Houghton-Gepp 1922/23 summer camp near Mt Wellington

It is remarkable that none of my research turned up anything at all about his private life. Apart from telling me he was married and had five children, he might have been an automaton. In fact, he had a rich and full family life, as I know from his friendship with my grandfather Edward (Ned) Haughton, a Melbourne real estate agent and auctioneer. I don't know when their friendship started – probably when some of their daughters were at school together at Ivanhoe Girls Grammar School – possibly an intermittent relationship, since Gepp took his wife Jessie, plus four smalls – Orwell, Dorothy, Constance and Kathleen – to Europe with him in 1911 for a year or so, and again to North America from 1915 to 1916, in the middle of the War!

Son Orwell was born in Broken Hill in 1906, but I wonder if the whole family ever actually lived there after his birth, or in Tasmania, since the three older girls did most of their schooling at Ivanhoe with my two aunts, and Orwell did his (senior) schooling at Melbourne Grammar School. Gepp owned a property, *Beaumont*, near Mt Wellington in Tasmania after 1916, but it seems to have been a family holiday camping place (see photos) rather than a home. I think the family probably settled somewhere near Ivanhoe where the girls were at school, and their father divided his time between Melbourne and Hobart.



The Gepp Family at "Strathalan", Macleod, c 1924.
Rear: Dorothy, Sir Herbert, Lolly Gepp.
Front: Kathleen, Mardi, Constance, Orwell.

About 1919, Gepp bought *Strathalan*, a farm with a beautiful house in a new suburb called MacLeod, close to Ivanhoe, and most probably sold by agent Ned Haughton. Certainly Ned was the agent when Gepp sold off a large part of the farmland soon afterwards for a housing estate, and to create MacLeod as*one of the garden suburbs of Melbourne because the building land adjoining the Railway Station on either side has been scientifically planned, and right at the station on the east is a large municipal garden reserve, providing areas for sports grounds, tennis courts, bowling greens and shady tree plantations, and these will be right in the town centre. It will make possible the "suburb beautiful" in a form never attempted and not possible in most suburban centres of the metropolis.*⁵ Bert Gepp was at his old social activism game! But be assured he kept enough land to support the family horses – and probably a cow or two.

1 See: <http://adb.anu.edu.au/biography/gepp-sir-herbert-william-bert-6298>

2 See reference on the previous page.

3 Australian Dictionary of Biography, Vol 8, 1981 – see link above.

4 Information from H.W. Gepp's personal CV in a family collection.

5 Pamphlet on Golf Links Hill Estate, MacLeod, from Haughton Collection, SLV.



The Gepps at Strathalan, MacLeod, c1924. L to R: Mardi, Constance, Orwell, Herbert Gepp, Mrs Jessie Gepp, Dorothy & Kathleen.

Right: The 1927 Ivanhoe Grammar School trip to Kosciusko. Herbert Gepp is in the front row at right. Kathleen, Dorothy & Neville (my Dad) are also in the front row.



With both families settled quite close, and the five girls schooled together (Kathleen, Dorothy, Constance and my aunts Gene and Vera), all members of the two families could play together. They initiated the children into the newly fashionable sport of skiing – at Mt Buffalo and later Mt Kosciusko. In 1927 Ned and Bert conducted a school skiing trip, with the boys from Ivanhoe Grammar, to the Hotel Kosciusko. They held big egalitarian tennis parties (even the maids and the groom played).

They formed the Coorie (riding) Club, and held gymkhanas to raise money for charity. They went riding on day picnics, or camping during holidays, usually with Mrs Gepp or my Grandma (both Jessies) following along in the car with tents, the food and the cook. To go far afield (the Grampians – Bright or Harrietville) they hired a railways horse box and took the horses along on the train with them. In the summer of 1922/23, the two families packed up everything – tents, the horses, all their gear, the groom, two maids, the cook, a couple of cars and took ship and train to Hobart, where they camped on the slopes of Mt Wellington for the summer.

In 1923, Gepp bought *Garden Hill*, a small farm in Kangaroo Ground, across the road from the Haughton weekender farm *Coorie Bank*. It was probably a day's ride from their homes in town, and they had the two farmhouses as a base for rides further into the bush.

I think Herbert Gepp had a wonderful time being a Dad, but I do wonder how much time he had to spare to be General Manager of the Electrolytic Zinc Co. Of Australasia Ltd.

The Editor



Tasmanian Camp 1922/23. Rear: Mrs G & Mrs H. Top Left: Mr G Top Rt: Mr H. Ladder from Top: Vera, Mardi, Dorothy, Constance, Orwell, Gene, Neville H (my Dad), two maids & the groom, front.

The Engineering Heritage of the Port of Clarence

The Premier River Port of NSW

Discovery and Settlement

The Clarence River, the largest coastal river in New South Wales, was not discovered by Europeans until c1828. It is 550km north of Sydney and 300km south of Brisbane (Moreton Bay). Northern NSW is blessed with an abundance of river ports suitable for sea-going vessels. Starting with early explorers out of Sydney Harbour – including the convicts who escaped to Port Stephens in 1790 and the fishermen who discovered the Hunter River in 1796 – there was soon a busy traffic of boats up and down the north coast of NSW, with the Hastings and Manning rivers added to the maps in 1818, and Moreton Bay in 1823.

The mouth of the Clarence River was seen, but not explored, by Captain Henry Rous in August 1828. It was an escaped convict, Richard Craig, travelling overland from Moreton Bay in 1831 who reported on the very large river he had crossed. Craig's later employers, Sydney timber millers Thomas and John Small, sent the ship *Susan*, built in their yard, up north to explore the *Big River* for stands of cedar in 1838. Soon after, in the same year, Captain James Butcher of the schooner *Eliza* explored a long way up the river from its mouth, and took a detailed description back to Sydney, printed in the Sydney Gazette, 8th December 1838:*Captain Butcher describes the river as navigable for vessels drawing nine feet water as far as Susan's Island (now part of the City of Grafton), which is situate about 80 miles from the entrance. The banks of the river are thickly covered with timber, fit for building vessels of any description. At a place called Pine Reach, about five miles above Susan's Island, Captain B saw a great abundance of pine trees, greatly resembling the English pine, and well adapted for making spars or for similar purposes. Some of the trees Capt. B saw, could not have been less than seven feet in diameter. The land on the banks of the river is generally of the finest description, and behind, are extensive flats of fertile land, luxuriantly covered, with grass, and fit for the immediate operation of the plough.....*¹

The next explorers, in 1839, travelling on the *Paddle Steamer King William IV*, included Captain Perry, the Deputy Surveyor General of the Colony, who was directed to: *communicate to the Government such information as might appear to him essential towards the future opening of the country on the banks of the river which it was intended to explore. The King William IV entered the river on the 25th May, when the vessel crossed the bar in two fathoms of water. The approach is round a beautiful grassy hill, forming the south head, to the northward of which is a reef of sunken rocks, that render the entrance somewhat hazardous to strange vessels. They explored the river as far as Susan Island where they found a settler called Phillips. Indeed there were more people: At this moment about 200 persons of various classes, viz., graziers, mechanics, farm servants and mariners, occupy the country between the mountains and the sea, At the head of the navigation a post-office has been established; a store also, for the supply of the settlers Several vessels are employed in the transport of articles of consumption*²

Possibly some time before the visit of Perry and *King William IV*, soundings and charts of the entrance and the river were in use and sailing ships, and soon steamers, were going up and down the river like yo-yos. Until the advance of the railways up the coast, coastal shipping was the only practical way to move goods and people up and down the coast, and it was the regular way to import the manufactured goods needed in the region, and to export the products of the region:– cedar (*toona ciliata*) from the forests – until that was all cut out; tallow and hides from the boiling down works; soap and candles made from the tallow; sugar from the mills; maize; gold and tin ore (from the tablelands?); and wool from the tablelands after the roads down the mountains to Grafton were built.

Coastal Shipping & Harbour Works

Grafton became the major river port on the Clarence, but there were also wharves at the little towns along the river – Yamba, Maclean, Palmers Island, Iluka, Lawrence, – at which steam ships much bigger than the 100 ton *King William IV* could dock. The navigable inland waterways of the Clarence River were the biggest and longest in Australia. Until the 1890s, shipping on the Clarence was a bit of a free-for-all, with many different firms competing for business, but the North Coast Steam Navigation Co. Ltd. (NCSNC) prevailed, and in 1908, with its considerable fleet including cargo steamers and three large modern passenger (and cargo) steamers, had pushed out or bought most of the competition. After the railways reached Grafton in 1923, coastal passenger traffic slowed to nothing in a few years, but regular cargo shipping continued until the NCSNC's last ship, the MV Wyrallah, departed Gladstone for the final time on 9th March 1954.



Paddle Steamer King William IV

Image courtesy the Newcastle Region Library

By 1860, so many ships were using the river, and possibly some of them had come to grief at the entrance, that the NSW Premier, Sir Henry Parkes, visited Grafton and promised financial support for the construction of breakwaters. This would be but the first of a succession of harbour entrance improvement schemes which went on for 90 years. Every one left its mark on the river mouth.

¹ Sydney Monitor & Commercial Advertiser, Supplement, Dec.1838.

² Report by the Deputy-Surveyor-General on the Clarence River, June 1839.

Moriarty's Scheme 1860-1889

The Engineer-in-Chief for Harbours & Rivers Branch of NSW Public Works Dept. (PWD), E.O. Moriarty, proposed building short breakwaters and rock training walls on both sides of the river entrance. Work started on the south side in 1862, using rock moved by horse tram from a quarry on Pilot Hill near Yamba. Work on the north side didn't start until 1874. Stone for the north wall came from a quarry at Iluka Bluff, also transported by tramway. Work went slowly and was abandoned in 1889, although part of the north training wall survives, known as Moriarty's wall.

Sir John Coode's Scheme 1893-1903

In 1884 a PWD engineer, Walter Shellshear, presented a paper to the Royal Society of NSW outlining his proposals for improving the entrance bars to the Clarence, Hastings and Richmond rivers, drawing on the experience of Sir John Coode, the distinguished English harbour engineer. The paper prompted the PWD to invite Coode to advise on the entrance works. He recommended modification to the main breakwaters, building internal training walls and breakwaters and removal of a rock reef at the entrance. Work started in 1893, with rock brought first from Angourie and then from Ilarwill, near Maclean, transported by punt to the site. By 1903 the training walls were complete, but the breakwater construction and reef removal were not undertaken.

Later Schemes, 1890 to 1950

In 1916, some realignment work was done on the northern training walls, but construction of a northern breakwater, as authorised in 1919, never happened until the Clarence Harbour Works Act, 1950 was passed, after which extensive north and south breakwaters were built, the final work being completed in 1971, long after the last regular NCSNC coastal steamer had gone to rest! Dredging was an important part of keeping the Clarence navigable, particularly between 1890 and 1950. Huge tonnages were removed, with up to five dredges working the channels. About 1900 the PWD built a dry dock at Ashby, across the river from Maclean, to service the dredges, and that survives today – now used to service the car ferries that are still used for some river crossings.

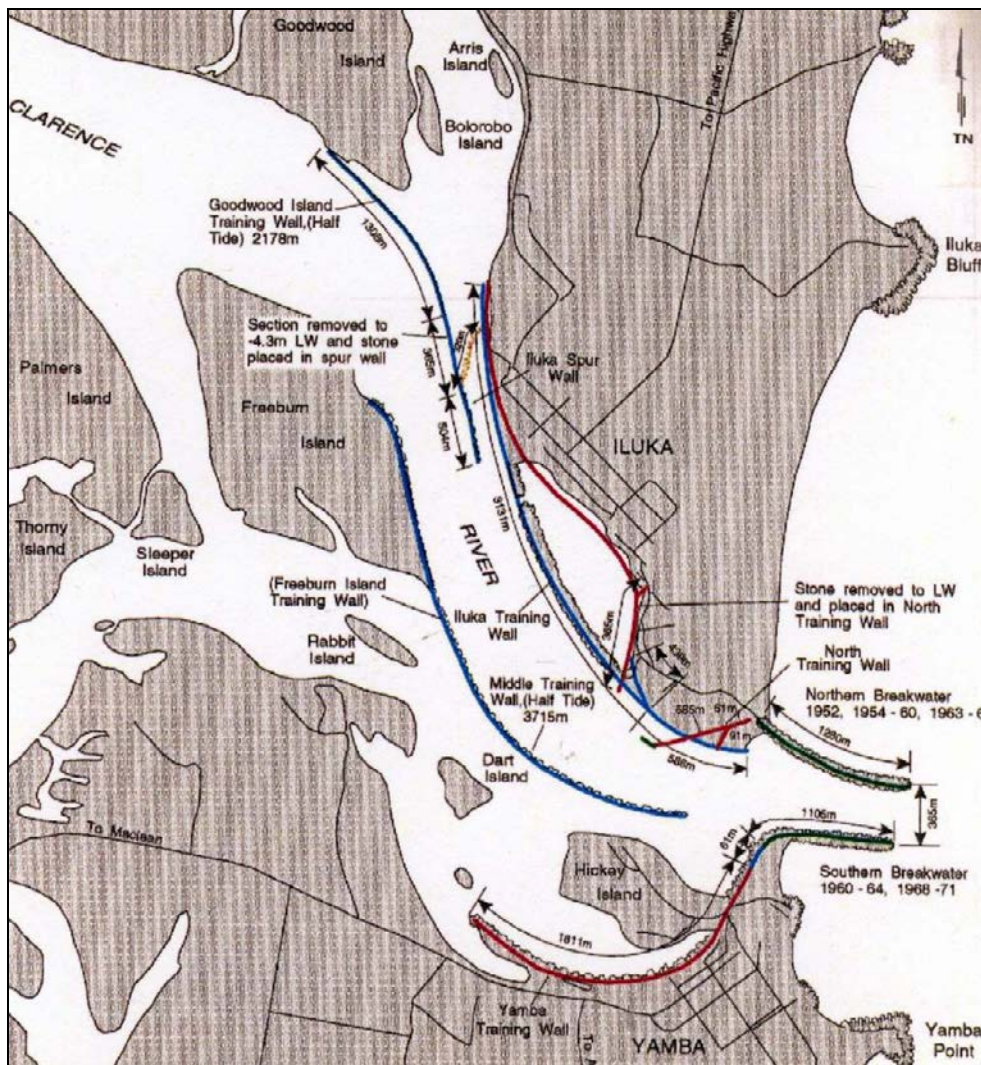
The Engineering Heritage of the Clarence River

At a Regional (Engineering) Convention in Grafton in 2009, Greg Mashiah, an engineer in the Clarence Valley Council, presented a paper *Ports, ferries & bridges: Clarence Valley's engineering heritage*. He later developed this into a nomination for the Engineering Heritage Recognition of the Port of Clarence, and the Heritage Recognition Ceremony, with the unveiling of a National Landmark marker, took place at Yamba in December 2012. Greg wrote of the significant surviving engineering heritage items in or near the river, including the training walls, disused quarries and tramways, and the still-in-use Ashby

Dry Dock. The training walls survive substantially as built and are still maintained. There are limited remnants of the quarries and tramways – sufficient for some interpretation. The disused quarries at Angourie became filled with water, and are now known as *Blue Pool* and *Green Pool*, and the Pilot Hill Quarry has been converted to a picnic area, with the quarry face still visible.

References:

Greg Mashiah's 2009 paper can be downloaded, free to members, via: engineersaustralia.org.au/resources-and-library Non-members can download it for a small fee by Google searching the full name of the paper. The nomination document (*Port of Clarence Heritage Nomination.pdf*) can be downloaded free of charge via: engineersaustralia.org.au/heritageregister/search Other references were the two foot-noted documents, and many other texts and images found via Google searches.



Map showing key components of the Clarence River entrance.

PWD 1995

