The Newsletter of
Engineering Heritage Australia

ENGINEERS AUSTRALIA

No. 20 - May 2008 Engineering Heritage Australia

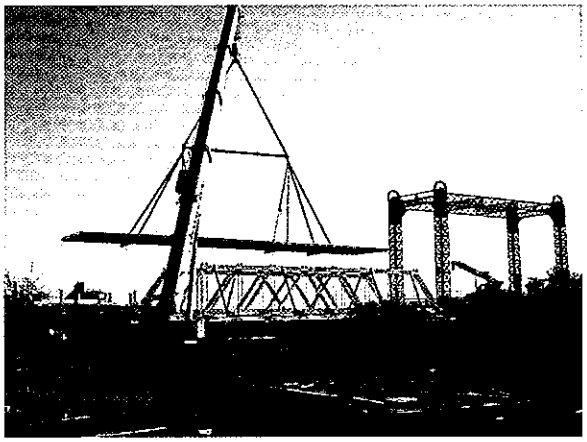
Colin Crisp Award 2007

won by Roads and Traffic Authority NSW for "Hinton Bridge Capacity Upgrade"

The 2007 Colin Crisp Award for Engineering Heritage was awarded to the Roads and Traffic Authority, NSW (RTA) for the "Hinton Bridge Capacity Upgrade" project. The award was presented by the acting Chair of Engineering Heritage Australia, Owen Peake, to the Regional Bridge Engineer, Mark Tilley, at the 14th National Engineering Heritage Conference Dinner held in Perth, November 2007.

The project was carried out by a project engineering team at the Newcastle Division of the RTA led by Tilley.

The Hinton Bridge was built in 1901 and has given 106 years of solid community service. In return, the bridge is much loved and admired by its local community. Characterised by its rare lifting span, it has become an engineering landmark of the Hunter Valley. It is representative of the finest bridge-builder skills from the 19th century. So in both these ways, the bridge deserves heritage protection and very sensitive conservation techniques to ensure its future utility and preservation.



Hinton Bridge Capacity Upgrade - Lifting a stress laminated timer deck into place

The RTA has responded well to this sensitivity in the manner in which it has carried out a total redesign to increase the bridge's capacity and durability. The works included:

- driven steel and bored concrete piling, concrete pile caps and timber trestle piers,
- new reinforced concrete abutment, strengthening of the existing concrete abutment,
- replacement of timber approach spans with concrete timber composite deck units,
- strengthening of timber trusses,
- stress laminated timber deck on steel cross girders on the three truss spans,
- rehabilitation of the steel lift span, and
- widening the approach spans, whilst minimising public road closures, so as not to inconvenience public access.

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Engineers Lead Celebrations for Great Northern Railway, NSW

On Friday 30th March 2007 Engineering Heritage Australia (Newcastle), EHA(N), managed the award of a Historic Engineering Marker to the Great Northern Railway (GNR), between Newcastle and Maitland. Ceremonies for the award were carried out at both ends of the line. The Governor of NSW, Her Excellency Professor Marie Bashir AO CVO, officated on a date exactly 150 years after the opening ceremony of the line.

To make the event a more auspicious and public occasion than just a Heritage Recognition ceremony, EHA(N) teamed up with a number of other heritage groups in Newcastle and Maitland to seek both government and corporate sponsorship support for activities over three days of the railway's 150th anniversary celebrations, named 'GNR-150'.

The Newcastle Marker unveiling event started the celebrations, and included a re-enactment of the first public railway journey between the two cities. Division President David Stewart was the host and main speaker for the ceremony held at Newcastle Railway Station. The Governor was welcomed to Newcastle by the Lord Mayor, Councillor John Tate. EHA(N) member Bill Jordan, who wrote the

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Engineers Lead Celebrations for Great Northern Railway, NSW

nomination for the award, talked about the 150 year history of the GNR and the Newcastle Marker was unveiled by the Governor, assisted by Past National President, Peter Cockbain.

Two special trains, carrying a full load of approximately 350 guests, then departed for Maitland. The official train was historical steam locomotive 3526 pulling a set of four heritage carriages. School parties, prize winners, and other guests followed behind in one of the new, diesel Hunter railcars. Both trains were sponsored by RailCorp, the owner of the Railway. The Chief Executive of RailCorp, Mr Vince Graham, and senior executives of United Group Rail attended the events.

Governor Bashir unveils the plaque at Newcastle assisted by PNP Peter Cockbain while Division President David Stewart watches

The rail journey ended at Victoria Street and East Maitland Stations, to closely re-enact the length of the original journey. At midday a reception and ceremony began for the awarding of the Marker for the Maitland end at the old Maitland Gaol. The reception was hosted by the Mayor of Maitland, Councillor Peter Blackmore. Peter Cockbain talked of the Engineering Heritage Marker Program and again assisted the Governor in unveiling the Maitland Marker. After the ceremony, the official party re-enacted an official luncheon provided by Maitland City Council held in the specially-restored Chapel of the Gaol, a fascinating environment. Tours of the historic gaol were available.

Community groups at both ends of the line enthusiastically assisted in re-enacting the public response to the opening of the railway: musical accompaniment at Newcastle Station was provided by the Junior Orchestra of Newcastle Grammar School and a Guard of Honour was supplied by the Australian Armed Forces re-Enactment Unit; at the Maitland Gaol ceremony members of the Maitland School Band entertained guests, while a GNR-150 school competition winner, the Glen William School Choir, gave a presentation of their winning song for the Governor.

On the following weekend, the organising groups combined to present a 'GNR-150 Train Show' at Newcastle Railway Station and a 'GNR Railway Expo' at the Honeysuckle Boiler-shop. The GNR-150 events were billed as part of the National Trust's 'Heritage Week'. A dedicated GNR-150 website was sponsored by local company StrategicIT, giving details of events and some good publicity for Engineers Australia, see: www.GNR-150.com.au

The Train Show included live steam demonstrations of 'the old' – a restored locomotive, SMR No.10 from Maitland. Interactive, manned displays of 'the new' were given by United Group Rail with brand new diesel and electric trains manufactured for City Rail services. A heritage Rail Motor was engaged to provide a shuttle service for the public to and from the Railway Expo adjacent to Civic Station. This free service proved very popular with families.

Community partnerships were valuable: the Railway Expo was organised by the Newcastle Industrial Heritage Association with contributions from many heritage groups and individuals. Display panels were mounted with historical photos and maps, and railway artefacts were collected together to tell the stories of the GNR and other industrial railways in the Hunter Valley. EHA(N) members gave live demonstrations every hour of the 1885 rope-driven Craven Crane on the gantry above the displays.

The Department of Education organised Hunter Valley school students in competitions for best artwork, story, or musical composition about the Valley's railways. The entries were placed on display in the Boiler-shop and a prize-giving ceremony concluded the event attracted many students and families.

Although no count was taken of the numbers attending, the 150th anniversary had been given good publicity by the media and many thousands of people were able to participate in the free celebrations, enjoying the fine weather during the event.

Rod Caldwell,
Chair, Engineering Heritage Australia (Newcastle)

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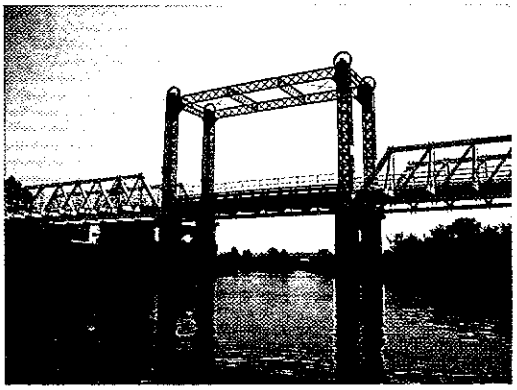
Colin Crisp Award



The Hinton Bridge crossing the Paterson River Hunter Valley, NSW

The above were achieved by engineering both traditional and modern composite materials into the structure. Site works commenced in 2004 and were completed in November 2006.

The appearance of the heritage bridge has been retained in the interests of the local community. The Allan trusses were strengthened by incorporating a steel plate in the timber lower chords, the remainder of the timber trusses remaining unchanged from the original design except for a minor increase in the size of the 2nd diagonal. The approach spans were widened using a composite concrete deck and timber girder design, improving road safety and durability, whilst maintaining the original load path, from timber girders, through corbels and into timber trestles.

The project was selected by the Colin Crisp Award Panel as an excellent example of the use of modern design and technology to both preserve and upgrade important engineering heritage works, with consideration for local sentiments and sensitivities.

Rod Caldwell

Book "Wooden Wonders" Highly Commended

The Colin Crisp Award presentations at the Engineering Heritage Conference in Perth on 21 November 2007 included a Highly Commended award to the book *Wooden Wonders – Victoria's Timber Bridges* by Don Chambers, published by Hyland House Publishing for the National Trust of Australia (Victoria). The 207 page book is very well illustrated and is based on research conducted by a committee of the National Trust. Most of the road and rail bridges described in the book still exist, either in service or in derelict condition.

Henry Jacob (Jack) Cowan AO

DEng, PhD, MArch, MSc, FIEAust, FIStructE, FASCE, FRSA, Hon. FRAIA, Hon. DArch (Syd.)

Jack Cowan was born on the 21st of August, 1919 in Glogau, Silesia a region of Germany that is now part of Poland.

In 1934 with the rise of Nazism Jack at age fifteen went to Whittingehame College in England on a scholarship. Later when only nineteen he earned his first degree – first class Honours in civil and mechanical engineering from Manchester University, the youngest man ever to achieve such an honour. Two years later in 1940 he gained his Master's Degree. On many occasions at university Jack couldn't afford to buy himself a cup of coffee, and often subsisted on only two hot meals a week.

In 1940 in the early years of World War 2 Jack along with many German Jewish men was interned as an enemy alien and deported to Canada. When he was cleared he returned to Europe to join others in fighting for a common cause. He joined the Pioneer Corps in 1941 and in 1942 was appointed to the Royal Engineers with the responsibility of defusing mines in advance of the regiment. However, in January 1945 near Eindhoven in Holland Jack's hearing and sight were damaged when an anti-personnel mine exploded. After some months he recovered and was honourably discharged from military service.

After a short venture into industry he accepted a position in 1946 as an Assistant Lecturer at the University of Cardiff teaching many war veterans. By 1949 he was serving as a lecturer at Sheffield University.

Jack and Renate Proskauer, a nurse, married on 23rd June 1952 and less than a week later they celebrated Jack's PhD from Sheffield University. Shortly after Jack was successful in his application for the newly established Chair in Architectural Science at the University of Sydney and took up the position in February, 1954.

Jack became a highly distinguished professor focusing on the structures of tall buildings, on torsion, and reinforced and prestressed concrete. At Sydney University he was Professor and Head of the Department of Architectural Science 1953-84; Dean of the Department of Architecture 1966-67; Pro Dean of Architecture 1968-84; and in 1985 he became Professor Emeritus Architectural Science. During the years 1962 to 1976 he was Visiting Professor in Architecture at universities in USA, Ghana and Turkey. He loved teaching and had an extraordinary tolerance for his students; he continued serving as a lecturer well into his retirement.

From The Institution of Engineers, Australia Jack was awarded the Chapman Medal (for a structural engineering paper) and the Monash Medal (general engineering paper), and from the Royal Society of Arts, the Hartnett Medal 1999. In recognition of his contribution to architecture the Royal Australian Institute of Architects made him an Honorary Fellow and for his outstanding contribution to the university, The University of Sydney awarded him an honorary Doctor of Architecture.

Throughout his career he held innumerable memberships and important positions in organisations and committees related to architecture, engineering and tall buildings; he established the Technion Society of NSW, and remained a corresponding member of the Royal Society of Arts.

He was an active and highly respected member of the Sydney Engineering Heritage Committee for over 20 years making valuable contributions to its deliberations, as well as being a delightful companion.

Jack was the author of twenty-one books, over two hundred articles and book chapters and over five thousand book reviews. His books included *From Wattle and Daub to Concrete and Steel*, 1998 and his autobiography *A Contradiction in Terms*, 1993. The title of the latter is a response in Jack's whimsical way, to the ridicule he received from the head of a highly regarded architecture school in London, that *'the very idea of architectural science was a contradiction in terms'*.

According to Professor Gary Moore, who at the time was dean of the Faculty of Architecture of the University of Sydney and was speaking on the occasion of Jack's fiftieth anniversary with the university, Jack, "...established the field of architectural

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Walkerville Lime Kilns

One of the remaining lime kilns at Walkerville South

At Walkerville South on the south coast of Victoria between Phillip Island and Wilson's Promontory are the remains of a quick lime burning facility which commenced operation in 1875 and ceased in 1926.

There were six kilns and significant parts of four of them remain. Each kiln consisted of a vertical brick cylindrical section, tapering towards the bottom. Layers of limestone (calcium carbonate) and firewood (coke was used in later years) were added at the top and after several days of burning the conversion process to quicklime (calcium oxide) was complete and the material was shovelled out of an opening at the base of the kiln and bagged. Transport to Melbourne was by ship from a wooden jetty at Walkerville. Bagged lime was loaded using a horse-drawn tramway.

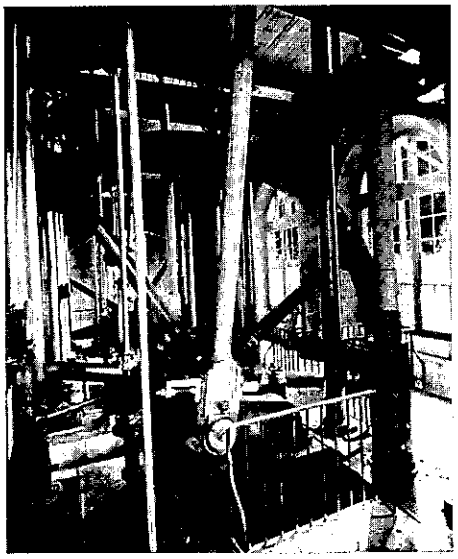
The kilns have now been out of service for over 80 years and there has been significant deterioration. Road-works carried out in 1938 caused considerable damage to the tops of the kilns whilst bushfires have destroyed most of the buildings in the adjacent village which housed up to 500 workers. The action of the sea has removed all traces of the jetty except for one wooden pile on the beach and has undermined the kiln structures. Parks Victoria now care for the site and have carried out considerable research, interpretation and preservation works.

The lime-burning industry was an important aspect of the development of early Victoria and the Walkerville site provided high quality quick lime to the fast-growing city of Melbourne and beyond. The conservation of this site, located on a beautiful section of the south coast, is an important engineering heritage achievement.

Owen Peake and Colin Oberin

A Peake at Steam

Botany Pumping Station



Engine House taken in 1895 just before the machinery was removed showing flywheels and connecting rods

Within the boundary fence of Sydney Airport are the remains of a very substantial Victorian Era steam pumping station which, from 1858 to 1886, was the major water source for the growing city of Sydney. The station drew water from the Lachlan Swamp north of the pumping station.

The stone and brick foundations which remain once carried three beam pumping engines manufactured in England by Thomas Perry & Sons. They were large engines with bores of 42 inches (1067 mm) and were designed to deliver 6.8 ML/d each to a service reservoir near the city.

A merchant named Simeon Lord apparently observed the comparative permanence of a stream discharging into Botany Bay east of the original mouth of the Cooks River and in 1815 erected a dam to provide water for two undershot water wheels. These provided power to a woollen mill and later a flour mill operated by Lord. The later pumping station site is close to where the Lord factories were located.

Consideration of the stream as a water supply source commenced with a series of very dry years around 1849. Supplies from the existing source known as Busby's Bore faltered and in January 1850 the Sydney Municipal Council appointed a Special Committee to consider a more permanent supply for the city. This committee deliberated for over two years and in February 1852 recommended that water drained from the Lachlan Swamp be pumped from Lord's Dam.

There was much delay and more inquiries while City Engineers struggled to design an acceptable scheme. On 12 December 1857 the Mayor of Sydney, George Thornton, laid the foundation stone at Botany. The station came into operation in November 1859.

By the early 1880's there was concern that the existing pumping installation was of insufficient size to meet the needs of the growing city. Towards the end of its life Botany Pumping Station came under pressure to increase production. Operating speeds of the engines were increased from 7 to 14 revolutions per minute.

Supplementary pumps were installed at Botany, however in 1885 the supply from the Prospect Reservoir was turned on and Botany was relegated to standby status until 1893, when the newly formed Metropolitan Board of Water Supply and Sewerage commenced disposal action.

The pumping station was auctioned in1896 and the machinery was removed. However the building was still in use during the Second World War and was probably demolished in 1950. The upper portion of the chimney was removed some time between 1945 and 1950 because it was a hazard to aircraft. From 1916 until 1949 it was used as a ventilation stack for the Southern and Western Outfall Sewers.

The Powerhouse Museum in Sydney has on display a steam cylinder from Botany. It is a great pity that this is all that remains of the three great beam engines that served Sydney so faithfully.

Owen Peake

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Henry Jacob (Jack) Cowan AO

science in the world as well as at [Sydney] University. In doing so he made the University of Sydney a worldwide centre of science in architecture.... He...demonstrated over fifty years, through his teaching, his research, and his scholarly publications, that this discipline that bridges architecture and applied science, is not a contradiction in terms."

He founded the *Architectural Science Review* in 1958 and served as its editor until 2006, but continued as the book review editor.

In his spare time, Jack loved the music of Mozart and enjoyed attending classical music concerts with the Australian Brandenburg Orchestra, the Sydney Symphony Orchestra, and Musica Viva. He was also a collector of books, stamps and wines. Travelling was another of Jack's pleasures; he made a number of overseas trips, returning to the UK and visiting Italy and other locations. He loved attending conferences in faraway places and kept on being invited back.

In 1940 because of the "blitz", the ceremony at which Jack was to receive his Master's Degree from Manchester University was cancelled. However, in 1990 the university wrote inviting him to celebrate the fiftieth anniversary of his degree at a graduation ceremony and so in 1990, fifty years after he had qualified Jack received his master's after having already earned three doctorates!

Jack had a quiet modesty; he never quite understood his own greatness and the scope of his wisdom, and he was unaware of his countless accomplishments. When he received the letter in 1983 advising he was to become an Officer of the Order of Australia, he said to Renate 'You really think I'm worth this?'

Jack Cowan was an engineer, a scientist and a man who was blessed with wisdom, sensibility, compassion, humility and a delightful sense of humour; he was a gentleman in every sense of the word.

On 15 July 2007 after a brief illness Jack's life came to a peaceful, dignified and good ending.

He is survived by his wife Renate and daughters Judith and Kitty.

The foregoing tribute draws on the eulogy given at Jack's funeral by Rabbi Paul J Jacobson of the Emanuel Synagogue, Woollahra, and on *Who's Who in Australia 2007. The photo is by courtesy of Professor Warren Julian.*

Michael Clarke

Donnelly River Timber Mill

The timber industry in Western Australia started shortly after the first settlement in 1829. As the existence of high quality West Australian hardwoods became more widely known the potential for timber export to other states and overseas emerged. As the state developed, the era of railway construction commenced, and considerable timber production was used for railway sleepers. The timber industry continued to grow and in the late 1950's there were 212 mills operating in Western Australia. However in more recent years the industry has been in decline.

No. 1 saw bench at Donnelly River Mill

After the Second World War there was a national building boom and the timber industry expanded to meet demand. Bunnings Limited commenced planning the Donnelly River Mill, situated some 300 km south of Perth, to work the karri forests in their permit area and it opened in 1949.

It had always been necessary to locate timber mills within forest areas to minimise the transport distance of the heavy logs to the mills. Coming shortly after the Second World War, Donnelly River Mill was based on heavy road trucking, which had become available from Army disposal, to move logs from the bush to the mill. This was a new technology compared to previous methods.

The mills had traditionally used steam power, a sustainable energy source in the timber industry as sawdust and waste timber were burnt in the mill boilers.

Donnelly River Mill was a traditional timber mill based on steam power. It was constructed using local materials wherever possible and used second-hand machinery purchased from other industrial sites. This illustrates the low-capital environment on which the timber industry depended, but also demonstrates the ability and ingenuity of the companies and their workforces.

Three Babcock and Wilcox boilers were purchased from Katanning Flour Mills in 1948 to supply steam to a single cylinder horizontal steam engine built by Robey of Lincoln, England in 1922 and purchased in 1948 from the Onkaparinga Woollen Mills in South Australia. Electric power for the mill and village was generated by two Bellis and Morcom high speed vertical steam engines directly coupled to alternators. These were also purchased second-hand.

The mill is almost completely as originally constructed, the dominant feature being the open-sided mill building under which all the mill working areas and machinery is located. The mill floor, supporting the operating equipment, is elevated to accommodate the counter shafts, pulleys and drive belts under the floor. The drive equipment being below floor level, instead of in the roof with belt drives coming down onto the work benches, achieved an open path for the movement of timber through the mill and also improved safety.

Very large karri logs could be handled in the mill. The "Elizabeth Karri Tree", displayed in Perth's Kings Park and obtained from the Donnelly forest, is 32.3 metres long and 2.4 metres in diameter.

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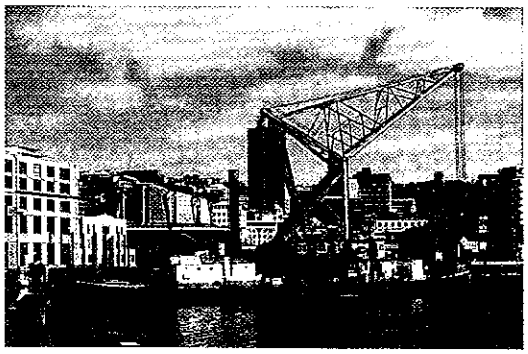
Comparing the View

A regular column by EHA past chair, Keith Baker

When the Engineering Heritage Australia Board met in Newcastle in June we had the opportunity to inspect the Craven Crane which was conserved by the NSW Government under the guidance of Carl and Margret Doring in the 1990s and is maintained and demonstrated by Newcastle Division in the historical Honeysuckle Railway Workshops. Built in England by Craven Bros of Manchester in 1885, it operated in its present location for over 70 years. Since its restoration to safe working order it is probably the oldest operating overhead travelling crane in Australia and the oldest crane of its type in the world (see EHA Newsletter 15A - Ed.).



The 'Hikitia' floating crane

Overhead travelling cranes have three distinct motions: a beam on wheels travels along overhead rails running the length of the building; a carriage or crab running on the beam traverses the bay between the rails; and a hoist attached to the carriage raises or lowers the load vertically. A unique feature of the Craven Crane is that the three motions are all powered by a single motor and rope drive running above one of the rails, contrasting with modern cranes which generally have independent electric motors for each drive.

More recently while in New Zealand on business I came across a distinctive steam driven floating crane at the Taranaki Street wharf in Wellington. The "Hikitia" was manufactured in Scotland by Sir William Arrol & Co of Glasgow in 1925, and is regarded by its owners as the oldest working ship of its type in the world. With a rated lifting capacity of 80 tonne it was tested with a 100 tonne lift in 2004 to retain its operating approval. As a jib crane its horizontal motion (slewing on a rotary base and luffing in and out as the jib is raised or lowered) is totally different to that of an overhead traveller, while the hoisting motion is recognisably similar. An interesting feature of the luffing motion is that it is operated by a large screw jack that appeared to be powered from the same steam drive as the hoist, along with the chain drive to the slewing gear.

Apart from the ingenuity of the early crane builders and the durability of their machines, I was taken by the parallels between the two cranes. Hikitia was rescued from being scrapped in 1990 and like the Craven Crane, was conserved and is maintained by enthusiastic volunteers. Both are very significant items of engineering heritage, and with different technology, each is regarded as the oldest operating example in the world. Yet when the Craven Crane was plaqued by Engineers Australia in 1996 it was awarded a Historic Engineering Marker as part of the workshop rather than a National Engineering Landmark. The reason apparently was that as an English crane it was not a landmark in Australian engineering, in spite of its extreme rarity and high degree of integrity. I wonder if we should have some other way of acclaiming world class examples of engineering heritage that we have been able retain for future generations. Our colleagues from New Zealand must have similar issues to consider. We will be discussing the way we commemorate our engineering heritage in a joint session with IPENZ when we meet in Perth for our next meeting.

Keith Barker

K1 – The Worlds First Garratt Locomotive Returns to Service

About a year ago the Tasmanian Association of Tourist Railways (TATRail) agreed to support the production of a brass plaque and to forward it to Wales in recognition of the historical and engineering significance of the world's first Garratt locomotive, and its long connection to Tasmania before it was returned to its maker in England for display in a museum. The K1 has recently been rebuilt and returned to service on the Welsh Highland Railway in Wales.

The plaque has been mounted on one side of the K1 locomotive engine above the leading cylinder. The remaining side is still free – possibly for an Australian Engineering Heritage Marker?

1st December 2004, first trials of K1 – watering at Caernarfon on the WHR. © Andy Rutter

Prior to farewelling the plaque TATrail committee members came together for a very entertaining presentation from Mr Charles Smith OAM - retired chief engineer of the Tasmanian Government Railways. Charles was not only instrumental in saving the K1, his passion for steam heritage saved the majority of our active mainline steam locomotives from the scrappers torch. Tasmania, like Wales, is indebted to Charles for his actions.

The bronze plaque reads *"PRESENTED BY THE TOURIST RAILWAYS OF TASMANIA IN RECOGNITION OF THE HISTORICAL AND ENGINEERING SIGNIFICANCE OF THIS LOCOMOTIVE -2006-"*

K1 is, I believe, the most significant locomotive to have operated in Tasmania and perhaps Australia.

The concept of articulation is almost as old as railways, however the frame of a conventional locomotive restricts the width of the firebox particularly on narrow gauge railways. The boiler must sit as low as possible to keep the centre of gravity low, and allow for good visibility from the cab. Driving wheels intrude into this space and the result can be a compromise with poor steaming qualities from a long boiler with a narrow firebox and restricted draughting.

Herbert William Garratt (b.1864)a British engineer with a career that spanned the Argentine, Cuba, Nigeria & Peru as a superintendent locomotive engineer was all too aware of the difficulties posed by light track and difficult terrain. He was an accomplished artist with some of his paintings hung in the Manchester Science Museum and he had become inventive as early as 1885 with a patent for improvements to the expansion of valve gear, and a boiled egg opener in 1901! In 1905 when his contracts expired he began design work on designs that showed two engine units with a pivoted central boiler unit and cab. The water and coal were carried on the two engine units, the short boiler of large diameter was low slung in the frame with a large firebox. He patented this in 1907.

Beyer Peacock's Gorton works in Manchester were aware of the demand for articulation in locomotives and had prepared designs in the 1890s for simple and compound Fairlies, and Mallet designs, including two different schemes for the 2' gauge of Tasmanian Government Railways (TGR). In 1907 Garratt's design secured interest from Beyer Peacock and the TGR for use on the North East Dundas Tramway (NEDT), which carried lead ore from the Hercules mine at Williamsford to the smelters at Zeehan on the West coast of Tasmania.

In 1910 two K class engines were shipped to Tasmania and put to work. This they did successfully until the late 1920's.

H. W. Garratt's initial work with Beyer Peacock was to provide that company with 50 years of building the most successful articulated design of steam locomotive. About 1640 Garratt locomotives were produced for railways across the globe. H. W. Garratt died in 1913 and did not see development of his idea.

The restoration of K1 included construction of a new boiler and firebox with capacity for oil or coal firing and was completed in 2006. K1 operates in regular service alongside the last industrial Garratt locomotives ever manufactured and exported to the South African Railways. The Welsh Highland Railway will be in the unique position of being able to use the first and the last built Garratt locomotives hauling passenger trains through the heart of the Snowdonia National Park all the way from Caernarfon in the North, to Porthmadog in the South by 2009. The Website http://whr.bangor.ac.uk/ provides further details on K1 and the rebuild of the Welsh Highland Railway.

Incidentally the writer along with family and friends restored the only first class two foot gauge passenger carriage to operate in Tasmania which was hauled behind the K1 on the NEDT. This can now be seen on the Redwater Creek Steam Railway in Sheffield, Tasmania - http://www.redwater.org.au/ .

Chris Martin
President – Tasmanian Association of Tourist Railways

Continued from page 5 - Donnelly River Timber Mill

The logs were progressively broken down to the required sizes at a succession of saw benches. A fourth bench usually produced less valuable products such as pickets. A fifth bench received discard material from No 2 and No 3 benches to be converted into fruit case material.

In 1978 the mill closed down for economic reasons after operating for 29 years. Due to technological changes occurring in the timber industry the equipment at the Donnelly River Mill could not be transferred to other mills. Bunnings agreed to leave the mill intact and it is now the last example of the complete steam-powered timber mill in Western Australia.

In addition to the mill, the mill-workers housing, workers club, boarding house, school and oval remain as a poignant reminder of the integrated community structure required to sustain an operational mill in a remote forest location.

In 1983 the mill and village was vested in the State Minister for Tourism to facilitate leasing the mill-workers housing and other buildings to a private company to run as holiday accommodation. The tourism authorities had no appreciation of industrial heritage or incentive to maintain the mill buildings or machinery, which have suffered from the resulting twenty years of neglect. The mill building is in a poor state of repair. There is concern about asbestos in the steam equipment, waterproofing of the mill roof and about termite damage to the building.

The mill was placed on the State Register of Heritage Places in 1996 as a unique industrial heritage site.

Following many expressions of concern about the deterioration of the mill, an inter-departmental consultative committee was established in 2003 to consider the future of the mill. It was eventually decided that the State Department of Housing and Works would carry out essential preservation work but documentation of this work has been protracted and is still incomplete.

The author gratefully acknowledges Jim Paton, author of the Conservation Plan for Donnelly River Mill, and the Heritage Council of Western Australia, which published it in 1994, for permission to use material from the Conservation Plan.

Tony Moulds

Recognised Engineering Heritage Works

Since our last edition went to press, the following works have been recognised with either a National Engineering Landmark (NEL) or Historic Engineering Marker (HEM).

- Great Northern Railway (HEM) - Mach 2007
- Launceston Water Supply (HEM) - October 2007
- Stuart Highway North (HEM) - December 2007
- Tathra Wharf (NEL) - January 2008
- Lake Margaret Power Scheme (HEM) - February 2008

HIFAR Reactor Honoured

The plaque unveiled on 1st June 2007 with guests including widows of key Australian Atomic Energy Commission employees.

At a ceremony on 1st June 2007 HIFAR, the High Flux Australian Reactor was declared a National Engineering Landmark. Warren Newell, President of Engineers Australia Sydney Division presented the commemorative plaques to the Australian Nuclear Science and Technology Organisation (ANSTO) at Lucas Heights, Sydney in the presence of over 125 guests. Many guests were past officers and employees, and during the ceremony posies were presented to Mrs Doug Ebeling, Mrs Mary Page and Mrs Gwen Roberts, widows of three former officers of the Australia Atomic Energy Commission (AAEC).

Construction of HIFAR, Australia's first nuclear reactor, commenced in February 1956. Achieving criticality on Australia Day 1958, it was opened by Prime Minister Menzies on 18 April, and after reactor physics measurements, began full operations in October 1960.

With commissioning of its replacement OPAL (Open Pool Australian Light-water reactor) imminent, decommissioning of HIFAR was initiated on 30 January 2007.

During its 47 years of operation HIFAR provided training for several generations of nuclear engineers and scientists and enabled Australia to pioneer many of the applications of nuclear science and technology to industry, medicine and education. Of particular note is the nation-wide distribution of radioisotopes for nuclear medicine and the application of neutron and gamma-based applications to industry. Equally, access to HIFAR's neutron beams by Australian Universities has led to the development of internationally recognised expertise in scientific research in the field of neutron diffraction. This base of research has justified the highly sophisticated neutron beam facilities on OPAL, with the expectation that world-class research will continue.

The wording of the NEL plaque reads:

HIGH FLUX AUSTRALIAN REACTOR (HIFAR)

HIFAR, Australia's first nuclear reactor, achieved criticality on 26 January 1958. Australian Atomic Energy Commission's (AAEC's) Commissioner-in-Charge Professor Sir Philip Baxter, Chief Scientist Charles Watson Munro, Chief Engineer (and Deputy Chief Scientist) Cliff Dalton, Engineer-in-Charge Bill Roberts and Instrumentation and Control Engineer George Page headed the team responsible for the works. Primary contractor Head Wrightson Processes (UK), main subcontractor International Combustion (Aust) and civil contractor Hutcherson Bros constructed it to a design by the United Kingdom Atomic Energy Authority, modified by AAEC. HIFAR enabled Australia to participate internationally in the early development of peaceful uses of atomic energy and to apply nuclear science and technology to industry, health, education and research. It was regularly upgraded in keeping with developing world and regulatory practice. HIFAR's working life ended with the initiation of its shutdown on 30 January 2007.

The Institution of Engineers Australia
Australian Nuclear Science and Technology Organisation 2007

The Australian Atomic Energy Commission (AAEC) commenced in 1952 with the objective of making the benefits of the peaceful uses of nuclear energy available to Australians. By arrangement with the British government, the first staff appointed were sent to Harwell in the UK to gain experience. By late 1955 there was a multi-discipline team of over 50 in the UK. The leaders of the Australian team were the Chief Scientist, Charles Watson Munro and the Deputy Chief Scientist and Chief Engineer, Cliff Dalton.

Also at Harwell under Watson-Munro were Bill Roberts and George Page.

As Senior Engineer, Bill Roberts returned to Australia to take charge of construction of HIFAR with much of the credit for the successful construction and commissioning being due to him. Later he was Operation Manager & Deputy Director at Lucas Heights.

George Page was in charge of instrumentation for HIFAR and made a substantial contribution to the design of the instrumentation and control equipment. He was a perfectionist with an uncanny perception of possible problems in complex systems. Later he was head of the Technical Physics Section at Lucas Heights and Deputy Director.

Sir Philip Baxter had been a consultant on the British post-war Atomic Energy Program and was involved in the construction of facilities at Harwell and Windscale. He came to Australia at the end of 1949 and joined the AAEC in its early days, rising to full-time Chairman in 1969. Baxter persuaded the Government that a nuclear reactor was essential for the activities of AAEC and insisted that it carry out original research. In 1954 Baxter and his research team at Harwell decided on a high-flux heavy-water-moderated reactor, which became known as HIFAR.

From both a historical and technical point of view, the HIFAR Research Reactor was of high social benefit to Australia and underpinned Australia's achievements in nuclear science and technology. It is of national engineering heritage significance and a milestone in Australia's scientific and technological progress.

Michael Clarke

Awarding Merit

This article celebrates two further Awards of Merit for Engineering Heritage. The Award of Merit shows appreciation to members of Engineering Heritage Australia committees and groups and their supporters and collaborators, recognising significant contributions to engineering heritage.

Dr Max Lay has had a distinguished career including the State Electricity Commission of Victoria, the Broken Hill Proprietary Company's Melbourne Research Laboratories, the Australian Road Research Board and VicRoads. He was Independent Reviewer for the Melbourne City Link Project, and is now a Director of ConnectEast, the group building the EastLink north-south Tollway in Melbourne. He has been a member of the Royal Automobile Club of Victoria for fifty years; for the past twenty years he has served as a Board Member, including a three year term as President.

Max is a Fellow of the Academy of Technological Sciences and the Chartered Institute of Transport. He holds an honorary appointment as a Professorial Fellow at the University of Melbourne.

The Victorian Division of Engineers Australia has awarded him the Warren Medal, the Transport Medal and the Monash Prize; the American Society of Civil Engineers awarded him the Mosseif Medal. In 1999 he was the Professional Engineer of the Year in Victoria. His role as "an educator and a historian" was included in the citation for his award as a Member of the Order of Australia (AM) in 2005.

Max has made a significant contribution to the recording and raising of awareness of engineering history and heritage through the authorship of three books and the presentation of numerous papers.

Mick Kent realised in 2000 that the remaining artefacts of the North Australia Railway (NAR), which closed in 1976, would disappear as the new standard gauge railway was built, largely within the NAR corridor. Mick set out to rescue and record as much as he could. Later he included the Overland Telegraph (OT) in the project because the railway largely paralleled the telegraph line.

Mick carried out many field trips between Darwin and Birdum, interviewed former railway employees, visited other states to track down ex-NAR rolling stock and searched available archival sources.

By 2001, with the establishment of the Friends of the North Australia Railway at the old Adelaide River Railway Station, restoration of artefacts from both the railway and the telegraph became part of the project. Mick has been responsible for much of this work.

The results of six years of research and writing by Mick are contained in a series of weighty documents. These documents are the most extensive records of what remains of the two iconic projects. Mick is continuing to expand this documentation.

Mick Kent has made a highly significant contribution to engineering heritage in the Northern Territory at a time when the surviving fabric of two major projects, its first railway and Australia's first telegraph connection to the world, are under immense pressure.

Enquiries about the Award of Merit program can be made to the Administrator, Engineering Heritage Australia, phone (02) 6270 6525.

Owen Peake

EHA Is Not Alone!

Our colleagues in New Zealand, the National Engineering Heritage Committee (NEHC) of IPENZ (Engineers New Zealand) publishes a newsletter which, in the June 2007 edition, starts off by promoting the 14th National Engineering Heritage Conference in Perth in November last year. It goes on to remind readers of the Australasian Engineering Heritage Conference in Dunedin, New Zealand, in 2009. All Australian engineers interested in Engineering Heritage will have an excuse for a trip to New Zealand in 2009 to attend this conference!

The NEHC system for recording and recognizing sites of engineering heritage significance is somewhat different from the Engineering Heritage Australia Plaquing Program. The process starts with the recording of information about a site on a database on the web site www.ipenz.org.nz/heritage and follows this up with registration of the site where appropriate. Following registration, arrangements may be made for special recognition by means of some, or all, of the following:

- the production of an information brochure,
- the provision of an interpretation panel,
- the installation of a plaque.

Two projects recently recognized were detailed in the newsletter.

An IPENZ plaque has been awarded to the Hapuawhenua Railway Viaduct near Ohakune 200 km north of Wellington. This curved steel viaduct was built in 1908 to complete the last link in the North Island Main Trunk railway line. The viaduct is 284 m long and 45 m high at its highest point. It was bypassed in 1987 by a new curved concrete viaduct located 100 m downstream. The original viaduct has suffered from neglect and corrosion since then. It is located in an inaccessible location within the Tongariro National Park with the only access being along the restricted railway corridor. The Tongariro Natural History Society has recently obtained funding from the Stout Trust for restoration work on the viaduct. Work is also under way to build a walking track which will provide public access to the viaduct.

In June 2006 the Bertrand Road suspension bridge over the Waitara River in north Taranaki was re-opened after several years of closure to traffic. Built in 1927 the current bridge replaced an earlier bridge at the same site. The bridge has a 61m main suspension span and is unique in that the main cables have a significant catenary in both the vertical and horizontal planes. The cables carrying the hardwood deck are supported on hardwood timber towers, one of which is at the top of a braced timber tower rising from near river level. Nearby residents formed the Bertrand Rd Suspension Bridge Trust which lobbied to have the bridge retained and raised money for its restoration. A Conservation Plan has been completed. Extensive reconstruction work was required with as much of the original timber as possible being retained.

Owen Peake

Using the Work of Yesterday's Engineers Today to Teach the Engineers of Tomorrow

For several semesters now I have taken the first year civil engineering 'Statics' class from the University of Technology, Sydney (UTS) to visit the Australian Technology Park (ATP) near Redfern in Sydney, NSW. As many would know, ATP was built as the Eveleigh Locomotive Workshops. Opening in 1887 it housed the machinery used to manufacture and maintain the rolling stock for the NSW railways. The building which was formerly the Locomotive Workshop has been refurbished and many of Australia's leading-edge technology research companies now have an office there. However, Bays 1 and 2 have been retained as a heritage display. This area contains some of the original equipment used in the workshop such as the Davy press.

Because of the building's industrial origins there are very few architectural 'fiddly bits' hiding the structural elements. From an educational perspective this has great benefits as I can touch or point to individual elements that are in full view as I talk about them. This helps the many 'visual' learners in the class to understand what I am talking about.

One of the other benefits of studying the original structural elements is that they were made in an era when the design imperative was to minimise material used. Another reason to minimise material for this particular building was that the structural elements were shipped out from England. This means that the material chosen, and shapes used, directly relate to the stresses the elements were designed to withstand (within the constraints of what was practicable at the time). Having the form following the function is helpful for students who are still coming to grips with what stresses are generated in structural elements and how they behave in response to those stresses. For example the original columns are cast iron with a hollow circular cross-section and taper slightly from the floor to the ceiling. A solid circular section of the same cross-sectional area would have a much lower second moment of area with consequently a much lower resistance to buckling. Of course buckling is not an issue for tension members so we note that in the wrought iron roof trusses, tension members have a solid circular cross-section. The joints in the roof trusses 'look' like pins so the students can see that they correspond to the 'pin-jointed' assumption of basic truss analysis methods. They are compared to the truss which makes up one of the crane girders. In this truss the joints don't 'look' like pins and I use this to start discussion of the differences between modelling and reality.

The materials and shapes used to create mezzanine levels in the refurbished areas allow us to compare original and modern structural elements on the same site. Differences in other factors considered by engineers in the two different time periods – 1880's and 1990's, are also touched on here, such as the relative costs of materials and labour, occupational health and safety practices, and methods of power generation.

Of course the students don't get out of the exercise without filling in worksheets which ask them to draw free body and bending moment diagrams and calculate the second moment of area for various structural elements seen at ATP.

Part of the cultural significance of heritage structures then is their usefulness in the education of the engineers of tomorrow. Observing the structural elements at ATP students can see the progress (well change at least) in one area of the profession of engineering. The students can 'learn' from the engineers of yesterday and the practising engineers of today by studying their work. This visible progression of the profession is similar to the progression that each student goes through to change from an 'L' plate engineer to a current professional.

The site visit is also a great excuse to get out of the classroom!

Anne Gardner

Senior Lecturer, Faculty of Engineering, University of Technology, Sydney

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This newsletter is published by Engineering Heritage Australia, a Special Interest Group of Engineers Australia. Please contact us on (02) 6270 6530 or visit our website at www.engineersaustralia.org.au and navigate through 'Learned Groups'. Editor Bill Jordan, assistant editor Lyndon Tilbrook. Contributions for the next edition gratefully accepted - email: eha@bjaeng.com.au