Uncovering and understanding Australia's first railway *

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SUMMARY: *In 1831 the Australian Agricultural Company (AACo) began operations of its first coal mine in Newcastle to serve the growing colony of New South Wales (NSW). It honoured an agreement (and contract of 1824) to take over the sourcing of coal from the NSW Government, which since 1801 had been carried out inefficiently using convict labour under supervision of the military. The mine was developed on "The Hill" overlooking Newcastle's Harbour and was connected to a staith (coal loader) on the wharf by a railway. With an official opening date of 10 December 1831, the railway can rightly claim to be Australia's first. However, for many years little was known about the design, history or archaeology of this railway to give this claim substance and credibility. This paper will first explain the historical background to the AACo's coal mine and railway based on evidence unavailable until recently. This evidence includes sketches of the mine and accounts from the AACo's records. It suggests that AACo carefully designed and resourced its first mines with technology of the time that was developed for mines in the northeast of England. In a second part, this paper will describe recent archaeological evidence and research that shows that the design of the mine and the supply of equipment for the railway was of a high standard for that time (c. 1826). The opportunity to do this follows a very fortuitous uncovering of an iron relic from the early AACo mines by local historian and co-author, David Campbell. Recent research of early rail line technology has provided an understanding of this relic and its historic provenance. International inquiries have led to the discovery that the railway line may be contemporary in design and supply with some of the very early English railways. Railway historians in the UK are also surprised that a rare, cast iron "fish-belly" rail section, similar to that used on their famous Stockton to Darlington Railway of 1825, could be found from a railway in Australia.*

1 UNDERSTANDING THE AACO HISTORY

1.1 Origins of the Australian Agricultural Company

The Australian Agricultural Company (AACo) was formed in London in 1824, having as its primary object: "producing wool of the finest quality, in New South Wales" (AACo, 1824) and was granted 1 million acres (405,000 ha) of pastoral land for this purpose (AACo, n. d.). A further 2000 acres (890 ha) of coal bearing land to the west of the convict town of Newcastle was added later, after the British Government sought to offload the burden of coal-mining into private hands. It should be noted that from its inception as a permanent settlement in 1804, Newcastle was a penal station, closed to free settlers until 1821 (Turner, 1982, Ch. 2).

In 1819-1821 (Royal) Commissioner J. T. Bigge visited NSW to investigate the Macquarie Administration. He reported the Newcastle coal mining operation as "inefficient and troublesome" and suggested privatisation (Bigge, 1822). The only private organisation with interests in NSW known to the British Government on to which the mines could be offloaded was the recently-formed AACo.

The following research of the AACo's mining history was gleaned by historian and co-author, David Campbell. His aim was to understand the nature and characteristics of the AACo's mining methods to provide a background to the historic house "St Ronans" situated in Bingle Street Newcastle. (The living room and cellar of St Ronans are believed to include the former engine house for the AACo's C Pit (Campbell, 2004)).

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1.2 The A Pit coal mine with its inclined-plane and gravitational railway

It was natural that the AACo officers should seek to develop collieries in the hilly area immediately to the south of Newcastle, for a workable seam, the "Yard Seam", was known to exist there. More significantly, a gravity-dependent railway could be laid to bring coal cheaply and efficiently down to the waterfront for shipping (AACo, 1830b). The company's A Pit of 1831, the first private and properly equipped colliery in Australia, was established at the intersection of Brown and Church streets, Newcastle. The mine was provided with a steam-operated beam engine for carrying out winding, pumping and, later, engineering purposes. A small pit was initially sunk to a shallow seam of coal, which was to provide fuel for engine operations during main pit sinking.

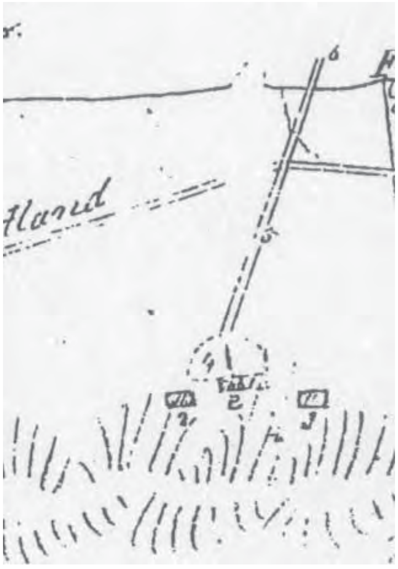

Figure 1: Only known plan of the AACo's A Pit mine and railway (excerpt from AACo Map No. AO Map 6268, State Records, NSW) – e = company's coal works; 1 = steam engine and pit; 2 = workshop; 3 = engineers' residence; 4 = coal yard; 5 = inclined plane and railroad; and 6 = wharf.

The main pit was sunk to the Yard Seam by the end of November 1831, but was not officially opened until 10 December 1831. It was bisected by an airtight partition, which provided both upcast and downcast airways for purposes of ventilation (AACo, 1830c).

Once raised up the shaft, the coal was yarded (see the coal yard in figure 1) or emptied into wagons; each of 1 t capacity. Loaded wagons were run in pairs down a self-acting inclined plane railway (two loaded wagons going down hauled another two emptied ones up). They were then pushed by hand, assisted by gravity, along a graded wooden trestle. It crossed a sandy area, now occupied by Hunter Street and the Great Northern Railway, to a loading staith at which small ships could berth while coal was tipped into their holds.

The most well known 1832 depiction of the A Pit was published in Turner (1982, pp. 34). The artist was the AACo's Accountant's Clerk J. C. White. The State Library of NSW holds a similar, but clearer sketch, also attributed to White, shown in figure 2. A more detailed account of the A Pit mine's history was provided by Longworth & Shoebridge (2007).

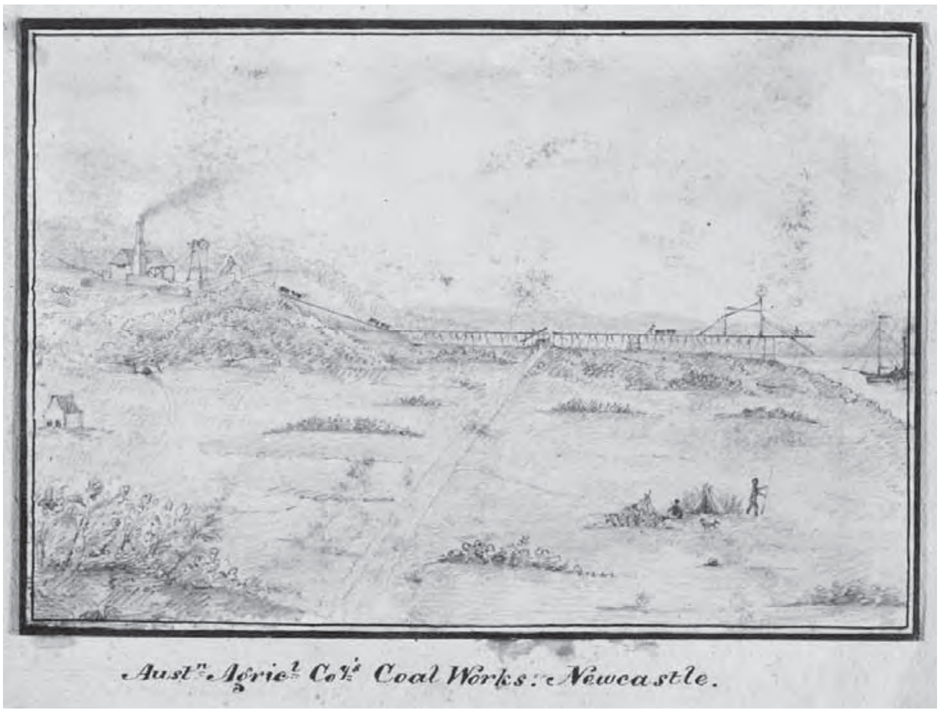

Figure 2: Sketch of the AACo's A Pit mine attributed to J. C. White, 1832 (State Library of NSW, SSV1B/NEWC/1840-9/1a128615).

Turner (1982, pp. 26) suggested that, in 1826 the AACo had dispatched "... steam engines, pumps, an iron railway and a mining party at considerable cost (which) had already committed it to the development of a modern colliery". This tantalising statement of a sophisticated industrial heritage failed for many years to stimulate much further interest. Furthermore, the consolidated, urban development of The Hill area since the mid 19th century has not encouraged archaeological discoveries – until very recently.

1.3 The B Pit and its gravitational railway

The company opened a new shaft, the B Pit, in 1837, mainly to assist in the ventilation and drainage of the colliery, although a good deal of coal was later found there (AACo, 1837; 1838). This coal was sent to the port, also along a gravitational railway, which connected with the 1831 railway from the A Pit. A shallow bench in the roadway at the lower end of Tyrell Street, Newcastle, is a remnant from the easement for this railway. The B Pit was particularly wet, probably because the workings had been developed beneath the ancient bed of the Hunter River and towards the dip of the Yard Seam (Legislative Assembly NSW, 1908b).

1.4 The C Pit with its inclined-plane and gravitational railway

In anticipation of reserves falling short, AACo decided that a new shaft, the C Pit, should be sunk towards the rise of the Yard Seam and near the crest of The Hill. This pit would, it was hoped, ease the water problem, for all three pits would be connected underground. The B Pit could then be maintained as a pumping shaft, allowing operations at the A Pit to cease. Lowering the C Pit was initiated early, in mid-1841, to make use of the last of the government's offer of cheap convict labour.

The elevated C Pit site provided enough height for another inclined-plane railway, similar to that used at the A Pit, to be installed. Wagon trains from the C Pit would feed onto an extended gravitational railway to reach the port (Legislative Assembly NSW, 1908a).

The C Pit reached the Yard Seam in April 1843, at a depth of 67 m (220 feet). At this time also, the inclined-plane railway was reported as being formed (AACo, 1841; 1843a; 1843b). Reports of the C Pit coming into full operation were not made, however, until after the A Pit was exhausted in July 1846 (AACo, 1846). Unfortunately for our research purposes, there is no direct report to confirm that the A Pit railway was directly transferred to form the C Pit railway. However, it could sensibly be expected that the inclined-plane railway of the A Pit was transferred to start C Pit operations when closure of the A Pit occurred.

In its operation, full skips of coal at "bank" (top area of the C Pit mineshaft) were pushed to the start of the inclined-plane railway, then clipped onto an endless hemp rope by which they were lowered down the incline (AACo, 1830a; 1840). The skips were then drawn by gravity down the lightly graded railway, and across the timber trestle to a staith. Speed was controlled by a brakeman, who actuated a wheel brake while travelling on the last wagon. Horses hauled the empty trucks back to the loading point. These animals returned down the incline on a flat wagon called a "Dandy Cart", attached to the rear of the wagon train (Legislative Assembly NSW, 1908a).

In the mid-1850s the C Pit mine closed because of severe geological difficulties. A photograph, c. 1908, of the area where the C Pit inclined-plane railway was laid, and where a later serendipitous archaeological discovery was made (see section 3.1), is shown in figure 3.

2 UNDERSTANDING EARLY RAILWAY LINE DESIGN

Before we can understand what type of railway line may have been utilised by AACo on its mining venture into Australia in 1826, it is useful to appreciate the development of railways in England prior to this period. Co-author and (retired) railway engineer John Brougham has researched this history and provided the following summary.

2.1 Pre-industrial revolution period

Wood (1838, pp. 7) made reference to the use of wagonways during the Roman occupation of Britain. But it was not until the 17th century, when the extraction and transport of minerals started to expand, that the use of tramways and wagonways began to be developed; particularly in the coal fields of northeast England.

2.2 Early timber "ways"

In 1676 the construction of one timber wagonway was described as:

> *... the manner of the carriage is by laying rails of timber from the colliery to the river exactly straight and parallel; and bulky carts are made with four rollers fitting these rails, whereby the carriage is so easy that one horse will draw down four or five chaldrons of coals and is of immense benefit to the coal merchants* (Wood, 1838, pp. 12).

These timber ways usually consisted of longitudinal timber rails fastened by timber pins to transverse timber sleepers that supported them. The space between the sleepers was filled to the top of sleeper level with road material to provide unimpeded footing for the horses hauling the wagons. The road material was also packed under the rail to provide additional support to the rails between sleepers.

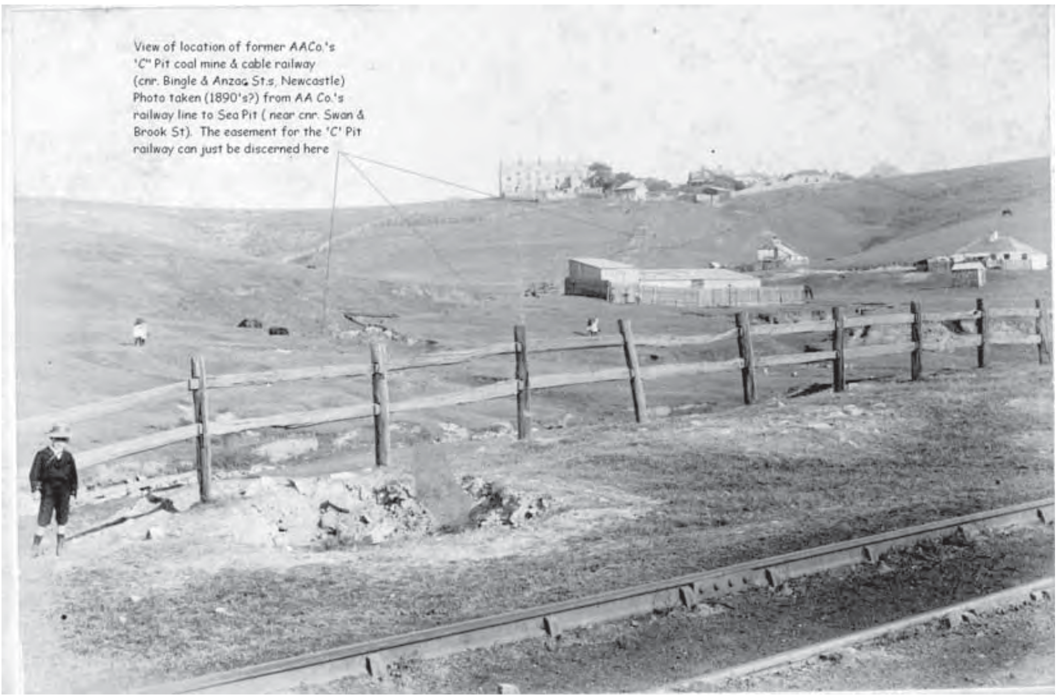

Figure 3: Easement for the inclined-plane railway of the AACo's C Pit coal mine can be seen below St. Ronan's in Bingle Street, Newcastle (Photo: Legislative Assembly NSW, 1908a).

2.3 Combination timber and iron rails

Metal was first introduced when wrought iron wear plates were attached to the top of the timber ways. This was usually on easements where there were adverse gradients, or on tight radius curves. The iron plates improved the lot for the horses hauling the wagons, due to the reduction in rolling resistance. It was not until 1738 that cast iron was first used as a wear plate but these brittle plates soon failed under traffic. Some 30 years later it was found that using smaller wagons linked together in place of one large wagon lightened the axle loads and resulted in a much reduced failure rate.

2.4 Cast iron plate rails (or tram-plates)

In November 1767, at the Coalbrook Dale Ironworks in Shropshire, the first fully-iron rails were cast in a 6000 kg batch (Wood, 1838, pp. 12). These rails were 900 mm long and 100 mm wide, with an upright flange on one side ranging in height from 50 mm high at the ends to 75 mm at the centre. The vertical flange on the side of the rails provided guidance for wagons with plain wheels, which enabled the wagons to be used on road and rail. Later developments to this form of rail included the addition of a second vertical flange beneath the rail – resulting in an increased load capability. Rails of this configuration were known as plate rails or tram-plates.

2.5 Cast iron edge rails

A typical example of the next development in cast iron rails was introduced in 1789 for a public railway at Loughborough. This rail, known as an edge rail, had no vertical flange extending above the running surface of the rail to provide guidance for the vehicle running on the track. Instead, the vehicle's wheels were flanged to provide this guidance. To provide adequate strength with the minimum use of material, a web or stem was cast under the rail head with the longitudinal section cast in a semi-elliptical or fish-belly shape. Initially, fish-belly rails had the bottom flange of the rail flared out at the rail ends to provide a supporting area for mounting on to square stone blocks or square timber blocks. Iron pins secured the rail to these blocks. This non-chaired design proved unsatisfactory in service as frequent failures occurred at the rail's end supports.

To overcome the breakages, separate rail supports, or chairs, were successfully introduced with a variety of designs for supporting and joining. Therefore, the chaired, fish-belly rails were developed.

2.6 Malleable iron rails

The first reference to the use of malleable, or wrought iron, rails was a report that, in 1805, a Mr C Nixon had tried out malleable iron rails at the Walbottle Colliery near Newcastle-upon-Tyne. The rail was described as being square bar about 600 mm long, joined by a pinned, half lap joint. Unfortunately, the trial was terminated due to excessive wheel wear and the malleable iron rails were replaced by cast iron rails with a broader running surface.

2.7 Longer malleable iron rail sections

In 1820 John Birkinshaw of the Bedlington Ironworks produced malleable iron rails of 5-6 m in length with a

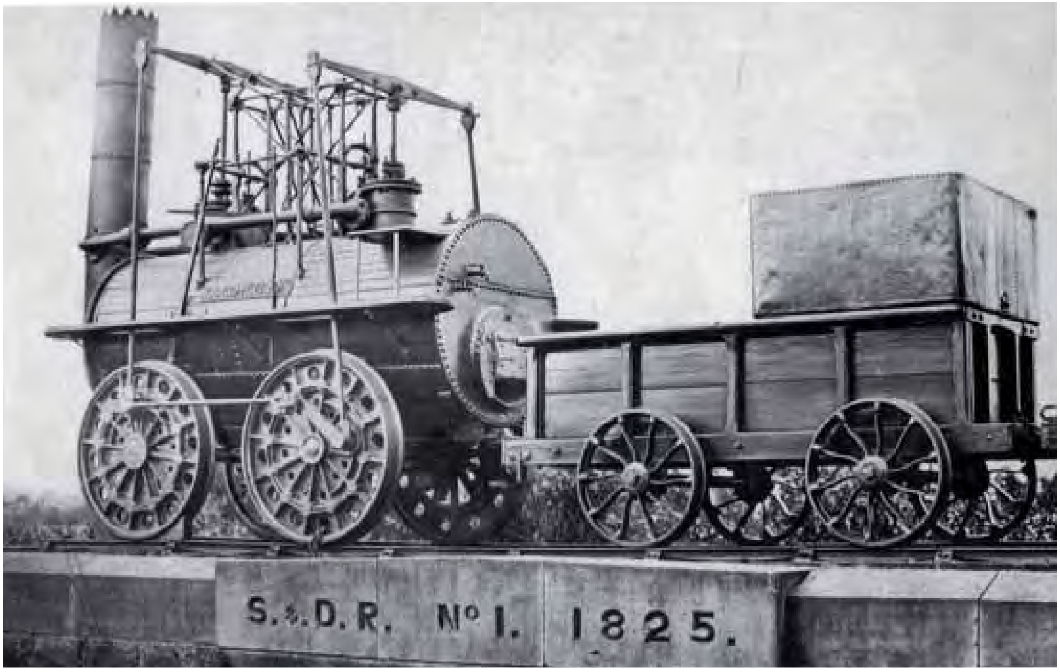

Figure 4: George Stephenson's 1825 LOCOMOTION standing on fish-belly rails at Darlington Railway Station.

wide head and the fish-belly profile being rolled along the length of the rail. When laid in the track, the rail ends were supported and joined at "joint" chairs with "intermediate" chairs supporting the rail between the fish-belly sections. It was claimed at the time that this form of malleable iron rail would supersede the use of cast iron rails on all public railways.

3 UNCOVERING THE AACO'S RAILWAYS

3.1 Sense and serendipity

During the course of his investigations into St Ronan's, David Campbell discovered what may be Australia's oldest railway relic. He had long since identified the route of the inclined-plane railway by which the C Pit was linked to the waterfront. In November 2004, during a walk along this route to establish the relationship of the railway to St. Ronan's, serendipity brought to light a remarkable, archaeological find: The demolition of a house at the corner of Kitchener Parade and Mosbri Crescent, Newcastle, had led to the excavation of foundations for a new house. In the spoil from the excavation, a strange, heavily-rusted piece of flanged iron bar drew David's gaze.

With appropriate permissions given, he rescued the rusted iron from the scrap heap and began to ponder: Could this ugly iron relic be in some way related to the AACo's C Pit mine or its railway?

3.2 Identification of the relic

Initial investigation of railway technologies in the mid-1820s strongly suggested that this relic could

Figure 5: Historian David Campbell announces in 2007 his find of fish-belly rail in front of "The Boltons", located on the original site of the AACo's A Pit mine and iron railway (*Newcastle Herald*, 2007).

indeed be a piece of iron rail of the fish-belly kind described in section 2. A public announcement of the find and the possibility that it could be Australia's oldest railway relic was therefore made in 2007 (*Newcastle Herald*, 2007), see figure 5. Shortly after, the relic was exhibited for the public at an "Heritage Expo" associated with GNR-150, Engineering Heritage Newcastle's celebrations for the 150th anniversary of the Great Northern Railway. (Later, the rail relic was placed in the care of the Newcastle Regional Museum, pending further research.)

At the time of David's find, there had never been any indication that a piece of rail of this fish-belly kind could ever be uncovered in Australia. The initial announcement of the find and public display at the Expo as a c. 1826 Australian railway relic was treated with some scepticism in railway historical circles. Doubts were raised: Was it just a boiler fire-box grate bar? Grate bars were also often cast in a fish-belly design. More research was therefore required to confirm the nature and origin of this relic.

A sketch of the found relic is shown in figure 6. It seemed obvious from the asymmetry of the piece, that one end (right-hand-side in sketch) had been broken off. This is commensurate with the historical reputation of the cast iron railway that it was prone to breakages. This broken relic might, then, have survived by being cast aside and gradually buried, long before the functioning rails were removed for as-yet-unknown purposes.

3.3 International inquiries lead to identification as fish-belly rail

A desired result of the public display of the relic in 2007 was that interest among railway historical circles was aroused. Inquiries with the sketch and photos of the relic were kindly forwarded to his colleagues in the UK by Bob McKillop of the Light Railways Research Society Australia. This appeal caught the attention of railway historian Michael Lewis, UK, author of Early Wooden Railways, who replied that the Australian discovery was an "... extraordinary find" (Lewis, 2007, pp. 1).

Most convincingly, Michael sent a photo of some historic rail sections that he had taken in 1970 at the Newcastle (UK) Discovery Museum. One rail appeared to be extremely similar to the relic recently found in Australia (see rail item on the left in figure 7). Michael said:

> *Like yours, it is 4ft long, it had a vertical rib near each end to locate it in the chair, and it ended in a semicircular male lug to fit a female socket in the next rail.*

Michael was able to contact a colleague at this Museum, and more relevant information was then provided by John Clayson, Keeper of Science and

Figure 7: 1970 photo of various cast iron rail sections at the Newcastle Discovery Centre. The rail on the left is considered to be very similar to the rail relic found in Newcastle, Australia, in 2004 (Photo: Lewis, 2007).

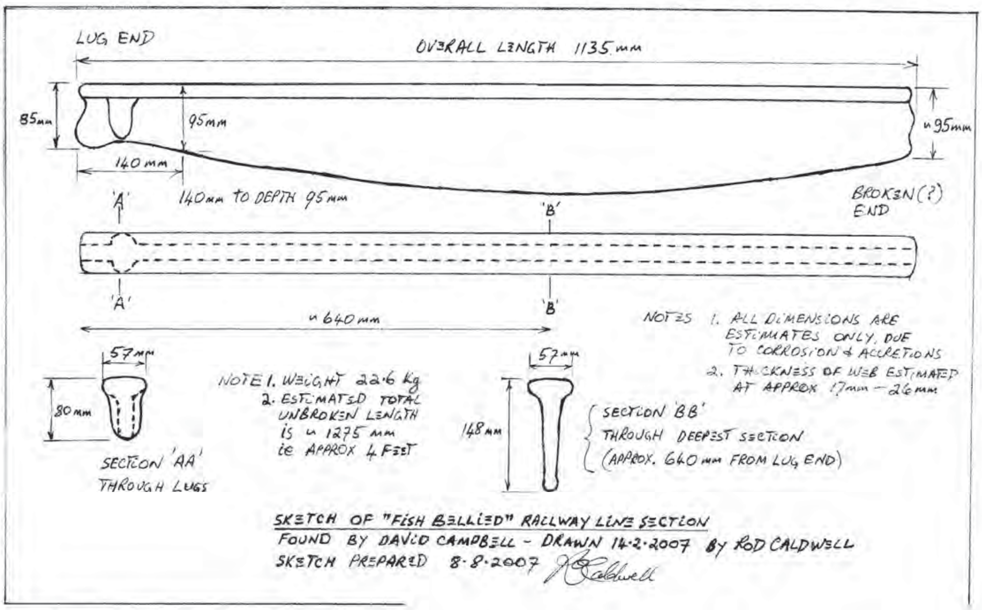

Figure 6: Outline and dimensions of fish-belly rail relic discovered by David Campbell in 2004 (sketch by R Caldwell).

Industry, Tyne & Wear Museums, based at the Discovery Museum Newcastle-upon-Tyne. John sent an excited email in reply (Clayson, 2007, pp. 1): First of all he sent measurements, which confirmed that its weight and size were as close as possible to that estimated for the Australian relic. But he also conveyed some good and bad news:

> *First, the good news – we do still have the cast iron rail you photographed in 1970. The less good news is that, at present, we cannot identify any information concerning either where it* [the rail section shown on the left of the photograph] *was found, or its arrival in our collection ... It may be that this Australian find could help us to identify and date our rail!*

Following exchanges of more information, John sent a detailed photograph of the other end of the rail section to enable researchers in Australia to understand how the rail sections might fit together and whether, or not, the design used either a separate or attached chair. This photograph is shown in figure 8. In a later email communication, Lewis (2009, pp. 1) responded:

> *I never thought to see a sketch of an Australian railway in 1832 ... rails of this sort would sit in chairs of roughly (but not exactly) the kind in the attachment [see figure 9], which is actually in Yorkshire rather than the Newcastle area. But it would fit the Discovery rail quite well, the arched top of the jaws fitting the narrow arched end of the two adjacent rails.*

This line of international inquiry is still going on. The authors thank our international colleagues for their research and hope that further collaboration will lead to the uncovering of further evidence that will benefit our mutual understanding of early industrial railways.

3.4 Further archival research

Just as exciting as the uncovering of these linkages to the early English railroads, further research of the AACo's records was carried out to confirm the use of iron rails in the company's early mines. This research was facilitated by material from the records of the Noel Butlin Archive Centre by archivist Dr Pennie Pemberton (Pemberton, 2009). The authors thank her for her contribution.

In a progress report to the company on 1 August 1830, Henderson, Colliery Viewer (Manager) for the mine, said: "... I brought out with me the first time half a mile of edge railway ..." (AACo, 1830b). He was referring to the company's shipping of its mining equipment on the AACo's chartered "... ship called the *Australia* ...", which arrived at Sydney on 17 January 1827. This and other direct references in these primary sources confirm that cast iron "edge rail" of the type described in section 2 were imported and used for the AACo's railway.

In a *General Report on the Company's Operations* of July 1831, AACo Commissioner Sir Edward Parry gave the most detailed description available for the final design of the A Pit railway:

> *It is now intended that about one fourth of the whole Rail-way should be on an inclined Plane, namely that part which descends the hill from the Pit's Mouth, the rest being dead level, or very nearly so to the Wharf. The inclined part is to be formed of Sand and Clay, coated on the sides with Turf to bind it – the level is to be entirely of round Timber* (AACo, 1931).

As to the provenance of the "colliery apparatus" sent out in the *Australia*, the minutes of the AACo Court (Board) of Directors also reveals new evidence: "... a letter from Mr Benj. Thompson of Newcastle upon Tyne conveying estimates and tenders for the supply of railroads and other apparatus for the coal mines in Australia" (AACo, 1825). It is thought that Mr Thompson was a purchasing agent for the company, for in the records of a subsequent Court meeting dated 31 March 1826, the Court resolved to approve a payment to Mr Thompson and to also pay: "... the invoices and bill of lading of sundry colliery apparatus &c shipped by the Sylph from Newcastle to London ...", including "... Owners of

Figure 8: Mating joint of fish-belly rail section at the Discovery Museum, Newcastle, UK (Clayson, 2009).

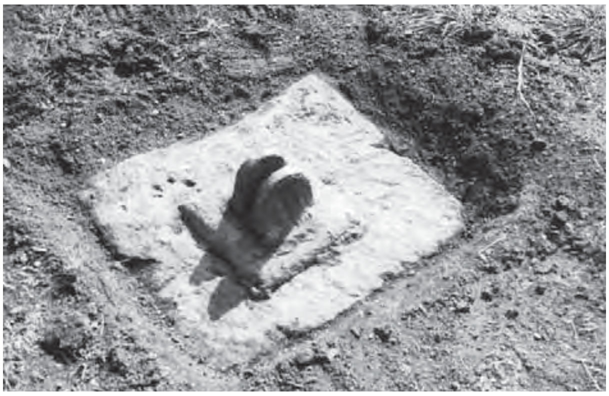

Figure 9: "Stanley Chair", suggested by Lewis (2009) as similar to the likely chair for AACo's fish-belly rail line.

Ayrton Banks Foundry (£)722.19.03 ..." (AACo, 1826). It is quite possible that this is the sum paid for the 1826 railway equipment; by far the largest of the colliery expenditure approved, apart from the two steam engines which were also brought out in the *Australia*. Further research can now be undertaken of the history of this foundry and its products to progress our understanding of the AACo's railway.

Intriguingly, an indent from Henderson of 18 February 1832 requested the supply, among other railway ironwork, of ".. Five hundred 4-foot Tram Road plates". This order was to be placed with "... J&T Cookson of Close Gate Foundry, Newcastle-on-Tyne, as they cast the best metal ..." (AACo, 1832). Whether this (post-opening) order was for extension, or maintenance of the edge rail in the incline, or for tram-plates as may be used in the mine, is not known, but the source also bears further research.

Nothing has yet been said in this paper about the gauge of the iron railways, as there has been no direct statement found in the AACo's research archives so far. However, Henderson's indent (AACo, 1832) also requested "Six dozen case hardened wheels for one ton wagons – of two feet diameter" (as well as wheels of 9-inches diameter, possibly for the skips in the mine). This reference is the only available clue to the design of the coal wagons used on the first railways, and therefore, a hint to the possible rail gauge used: It is unlikely that the "two feet" wheels would have been used on a wagon with a rail gauge less than about 3-feet 6-inches. In fact, the contemporary Stockton to Darlington line was laid at a rail gauge of 4-feet 8.5-inches, and this was the usual gauge adopted at that time in north England.

4 CONCLUSIONS

Uncovering of the iron relic, the associations with UK technologies and new archival research outlined supports our understanding that the AACo did install up-to-date railway (and coal mine) technologies for its 1826 mining venture into Australia. It confirms that the latest rail line equipment of the time, fish-belly edge rails, were used for the AACo's A Pit railway. This apparatus is identical, in most respects, to a museum piece in the Discovery Museum, Newcastle, UK. It is similar to that which was used, for example, on the famous English Stockton to Darlington railway line of 1825 (figure 4).

The AACo's records reveal that the A Pit operations ceased at about the same time that the C Pit mine was being developed. So it could be expected that the valuable and reusable iron railway was transferred to this site. The layout of the inclined-plane/gravitational railway built for the C Pit is recorded as being very similar to the earlier A Pit installation. The iron relic found by David Campbell in his 2004 survey of the C Pit railway site was, then, providential in uncovering what now can rightly be recognised as Australia's oldest railway relic (possibly 183 years old in 2009).

On behalf of Engineering Heritage Newcastle, the authors thank and recognise the contributions of Dr Pennie Pemberton for her research of the ANC's Noel Butlin archives; as well as Bob McKillop, Michael Lewis, John Clayson, Don Hagarty, John Shoebridge and others for their comments and interest. The authors hope that this may be only the start of a research effort to more completely identify the history of these very early engineering works. The AACo's mining venture well deserves recognition for pioneering the adaptation of European mining and railway technologies into the Australian environment.

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DAVID CAMPBELL

David Campbell graduated with a BA (Hons) in Classics, and MA for research into the economic and political history of railways in the Hunter District from the University of Newcastle. He served for over four years in the Australian Army Reserve and as an Officer of the Royal Australian Air Force, and later conducted historical research on behalf of several parties. David's decision to marry necessitated his working for some years in the hospitality industry. Having been appointed a Life Member of the University Union, David subsequently took a Diploma in Education and became a high school teacher. David is proud to have been able to draw attention to several historical structures and artefacts, and also to assist, where possible, in their preservation. He is now pursuing a degree in Law, and relaxes by studying transport, political, religious and military history.

JOHN BROUGHAM

John Brougham started work in 1950 with the South Australian Railways as an apprentice fitter and machinist at the Islington Railway Workshops. In 1953 he was granted a cadetship, which enabled him to continue his studies at the University of Adelaide while working in the drawing offices at Islington. During this period he completed his National Service in the Navy in the Engineering Branch. He graduated with a BE in 1960 and the following year transferred from the Mechanical Branch to the Chief Engineer's Branch, where he was involved in structural and mechanical design in the Adelaide Drawing Office. He was appointed Assistant Engineer, Peterborough, in 1963 and in 1965 took up the position of Resident Engineer, Ceduna. In 1966 he was appointed Divisional Engineer, Port Lincoln, and in 1969 returned to Peterborough as Divisional Engineer. In 1970 he returned to Adelaide where he took up the position of Plant Engineer in the Works Section. John is a Member of Engineers Australia and the Railway Technical Society of Australasia. He was elected an Associate Fellow of the Permanent Way Institution in 1984 and remained a member of the South Australian Section until relocating to Newcastle in 2002. He is a member of the Heritage committee of the Newcastle Division of Engineers Australia.

ROD CALDWELL

Rod Caldwell gained professional qualifications in Science and Engineering (Electrical) at Sydney University. After several years industrial experience, he was selected to carry out research into the high voltage behaviour of electrical insulation at the University of Queensland, gaining a Masters degree in Engineering Science. This experience began a 35-year career as an engineer/manager in the electricity supply industry. The peak of this career was reached in the role of senior engineer with responsibility for the supply of bulk electricity and development of the NSW electricity high voltage grid in the northern half of NSW from 1987 until 1996. Throughout this career he carried out research on the development of high voltage earthing equipment as a member, and Chairman for many years, of TransGrid's HV Safety Equipment Committee. In 1986 Rod changed career course to pursue his love of heritage and became CEO of the Hunter Wetlands Centre, based in Newcastle. Taking a more industrial direction, he subsequently took up the position of Curator of the Fort Scratchley Historical Society in Newcastle. In 2000 Rod won a Britain-Australian Bicentennial Fellowship for the study of heritage at the prestigious Ironbridge Gorge Institute and subsequently gained an MA in Heritage Management from Birmingham University. More recently, Rod rejoined Engineers Australia and has become Chairman of Engineering Heritage (Newcastle).