Running on time

Clocks and timekeeping
in the NSW Railways

Contents

Railways brought with them, in their train as it were, many standardised elements requiring precision and discipline. You queued for a ticket, you obeyed the guard or the porter when they told you to embark or disembark. And these men were not independent, they were merely servants of an implacable mechanical machine, bigger than them, composed not only of locomotives and trains themselves, but also of an organized hierarchy... their most obvious effect was the standardisation of time. No longer could peasants and their masters live by the rhythm of the sun. If railways were to provide a regular service they had, necessarily, to conform to some form of schedule.[1]

Figure 1: Central Station concourse c1986 showing the suspended concourse clock and original indicator board (Source: Sydney Trains)

About this report

This report outlines the history and development of a standard system of timekeeping in the NSW Railways.

This history traces the evolution and introduction of 'railway time', and the physical manifestation of a standard timekeeping system via the various clocks, watches and recording devices that connected the rail system across the state. The technological changes in timekeeping systems and the role of time in both safe working of trains and passenger information services across

the network were integral to an expanding railway network. This report also documents the history of collecting railway clocks and their wider interest as collectable antiques. During the preparation of this report, a series of interviews were conducted with railway staff and NSW clockmakers who service the historic clocks, maintain the collection and run the current systems of time information across the network. The aim of this report, as well as the short documentary film that accompanies it, is to collectively capture the important historical theme of 'railway time'.

Time and travel before the railways

One of the scientific challenges facing eighteenth-century Europe was the search for a dependable and accurate method of keeping regular time as a key component of maritime exploration and trade.

Clockmakers were among the leading figures in European science, and clock technology advanced rapidly throughout the 1700s. Whereas pendulum clocks at the beginning of the 1700s were accurate to within 15 to 20 seconds per day, by the time of the First Fleet's arrival in Sydney (1788), small portable clocks were accurate to within a second.

Accuracy was vital for shipboard navigation and ships sinking due to poor navigational charts or not knowing their exact location in relation to the charts was an all-too-common occurrence.[2] Although latitude had long been easily calculated, longitude was a more complex problem. In 1707 the loss of four English warships and 2000 men off the south-west coast of England, due to a navigational error, prompted Queen Anne of England to offer a £20,000 prize in 1714 for the 'discovery of a practical and useful means of establishing a ship's position by longitude'.[3]

The reward sparked a scientific race, won by Yorkshire clockmaker John Harrison, whose first sea clock was proven accurate on a short voyage from London to Lisbon in 1736. Harrison's next four sea clocks, tested on voyages around the world between 1741 and 1770, transformed ocean travel and exploration in the eighteenth century by allowing an accurate measure of Greenwich Mean Time to be kept on ship. This then led to a number of London clockmakers producing cheaper, less complicated versions for commercial sale.

One such clockmaker, Larcum Kendall, produced a serviceable copy in 1772, based on Harrison's fourth version, in the form of a watch rather than a clock. Although not as reliable as Harrison's, Kendall's watch, known as 'K2' sailed with Captain Cook on his second voyage in 1772. The very same watch was given to Captain Phillip in 1787 to assist in his command of the First Fleet before it left for New South Wales.[4]

The need for accuracy in maritime timekeeping in the eighteenth century mirrored the same requirements for correct measurement of time that would later be necessary for the efficient and safe development of the railways in the nineteenth century.

1   Faith, Nicholas, *Locomotion: The Railway Revolution,* (London, BBC Books, 1993), p. 20

2   Sobel, D, *Longitude* (Fourth Estate, London, 1998), p. 14
3   Davidson, G, *The Unforgiving Minute: How Australia Learned to Tell the Time* (Oxford University Press, Melbourne, 1993), p. 10
4   Davidson, op cit, p. 11

The arrival of time in Australia

The arrival of the First Fleet in Sydney Cove in January 1788 represented the transplanting of the European rule by time as well as the British occupation of the Australian Continent.

One of the subsidiary tasks assigned to the First Fleet officer William Dawes, in his role as representative of the Royal Observatory, was to establish British standard time in the new colony. Dawes erected a pole outside his tent at Dawes Point on Sydney Harbour with one of his clocks attached to it, signalling the start of public timekeeping in Australia.

In 1796, regulations for convict working hours likely encouraged Governor Hunter to erect the first clock tower in the colony, installing a church clock mechanism he had brought with him from Europe. The square tower, built on Church Hill in 1797 on the western side of the town, was 46 metres tall and visible across the entire town. The tower was extensively damaged in a storm in 1799 with another storm in June 1806 causing the whole thing to collapse.[5] In October 1806 work began on a second tower and new church, this time on a smaller scale standing only 14 metres tall.

An image of the west side of Sydney Cove c1800, showing the public clock tower dominating the skyline before its collapse in 1806 (Source: SLNSW ML443)

Figure 2: An image of the west side of Sydney Cove c1800, showing the public clock tower dominating the skyline before its collapse in 1806 (Source: SLNSW ML443)

In the time between the collapse of the first tower in 1806 and the rebuild of the second in 1807, public time was conveniently kept by a watchmaker with a time piece attached to the adjoining window where he worked. He was probably the watchmaker Henry Lane, who advertised in the *Sydney Gazette* in June 1806.[6] The new, smaller, town clock tower was completed in July 1807 reusing the original salvaged clock mechanism.[7]

With the arrival of Governor Lachlan Macquarie in 1810, time and timekeeping became more formalised. A number of new public buildings included clocks in their facades and a new position of Government Clockmaker and Keeper of the Town Clock was created to service them. Macquarie's first three appointments to the role were all experienced clockmakers who had been transported as convicts. The first appointed in 1811 was Henry Lane, succeeded by John Austin in 1815 and James Oatley in 1819. Oatley was set to work building a clock for the new Hyde Park prisoners' barracks. This clock is the oldest surviving public clock in Australia.[8]

As the main settlements of Sydney and Parramatta grew, clocks were installed on a range of public buildings. Parramatta had clocks in the tower of St John's Church, and another large clock on the gable of the Female Factory. By 1821, a clock was installed in the tower of St Peter's Anglican Church at Campbelltown, another in the tower of St Luke's at Liverpool with a third in the tower of St Matthew's at Windsor. Clock time was also reinforced by the peeling of church bells on the hour.

The clocks that Macquarie installed across the colony were part of his broader scheme of bringing order and regulation to the convict workforce. However, beyond the main towns, on the farms and estates on the fringes of the settled areas, public clocks were largely non-existent. Privately assigned convicts were not usually set prescribed working hours, with most working through the daylight hours.[9] As small towns became established in the outer districts, local churches, the courthouse or other public buildings were fitted with public clocks, slowly spreading the time across the colony. These clocks provided a measure of time to these new outposts, but the concept of regulated time was not yet in place and the spread of accurate time was slow. With no communication between settlements other than by road or water, each town had a local time that may differ by some minutes from the next town or from the major cities.

As Sydney grew, so too did the need for a more reliable timekeeping system. In July 1832 the newspapers reported that to overcome the problem of irregular and mismatched public clocks, the superintendent of Government

Figure 3: Hyde Park Barracks clock, 2007. Installed during Macquarie's era. It remains the oldest working public clock in Sydney (Source: NSW Department of Environment)

clocks was to send a watch to Mr Dunlop, the astronomer at the Observatory at Parramatta where, with the help of the chronometer at the Observatory, he would set the watch. This time would be considered the regular time which would, in turn, be used to set all public clocks.[10] At this time there were only three public clocks in Sydney, with a fourth added to the Post Office cupola in 1834.

Despite the best efforts of the authorities, unreliable public clocks remained a constant irritation to the people of Sydney throughout the first half of the nineteenth century with similar complaints made at Parramatta, where various town clocks were often stopped, different to each other or varying up to a full half hour to that in Sydney.[11]

5   Bridges, P, *Foundations of Identity: Building Early Sydney 1788-1822*, (Hale & Iremonger, Sydney), p. 32
6   *Sydney Gazette*, 8 June 1806, p. 3
7   *Sydney Gazette*, 7 June 1807, p. 4
8   Broadbent, J & J. Hughes (ed), *The Age of Macquarie*, (Melbourne University Press, Melbourne, 1992), p. 126

9   Davidson, op cit, p. 28
10 *The Sydney Herald*, 30 July 1832, p. 1
11 *Sydney Gazette*, 27 August 1833, p. 2

The coming of the railway and the first clock systems

While the keeping of time spread haphazardly across NSW, it was the establishment of a rail network in the mid-1850s that bought about a standard time measure for the state.

As the railways spread out from Sydney and Newcastle, connecting their hinterlands to the coast, the need for accurate time to allow for the timetabling of trains and for arrival and departure times for passengers meant that a common, standard time had to be known at each station.

The first public railway to open in New South Wales ran between Sydney and what is now Granville (then known as Parramatta Junction), with stops at Newtown, Ashfield, Burwood and Homebush. Most of the line was built by a private consortium, the Sydney Railway Company, but was taken over by the Colonial government just prior to the line being opened in 1855. This marked the start of the New South Wales Government Railways, the colonial forerunner of today's Sydney Trains. The government also took control of the Hunter River Railway Company which had similarly struggled financially building their line from Newcastle to Maitland which opened in 1857.

Figure 4: The second Sydney Terminal building c1879 showing one of Tornaghi's clocks in the gabled end (Source: SRNSW).

In the first decade, building the lines was reasonably quick, with an extension through Parramatta to Blacktown completed by 1860 and onto Penrith by 1863. Within the next two decades, the railways reached Albury and Hay in the south, Bourke and Mudgee in the west, Tenterfield and Narrabri in the north-west and connected the southern Sydney suburbs of Hurstville and Waterfall to Wollongong via the Great Southern Line. In 1889, construction of a bridge across the Hawkesbury River connected Sydney to Newcastle, enabling a unified mainline system to be formed.[12]

Safe and efficient running of the new and expanding train network depended on a reliable method of timekeeping across the system. The opening of the Sydney railway in 1855 coincided with the relocation of the Observatory from Parramatta, where it had been since the 1830s, back to the city on a new site at Flagstaff Hill above Millers Point. One of the purposes of the new Observatory was to provide accurate time to the growing city via a time ball on top a tower on the site.

Though the time ball was most useful to ships' captains who could set their chronometers by it, with the development of the railways and their need for accurate time, the time ball quickly became an indispensable part of the railway time-measurement system. In 1858, building of the time ball tower and the Observatory were completed and in June 1859, the time ball was used for the first time. It originally fell at midday, but was changed to 1 o'clock soon after by the Government astronomer who was otherwise making observations of the sun crossing the north-south meridian at 12.00 noon.[13]

The time ball was connected to the railways via a telegraph wire. At first guards set their watches by the station clock at the start of each journey, with no apparent method of synchronising the clocks once the train left the station. With only a single line between two stations, this was adequate for safe working of the system. As the new system grew and branch lines were connected, the advantages of the telegraph for the safe running of the railways were increasingly appreciated.[14] The telegraph was also used in the 'block system' of signalling that ensured only one train could pass along a section of line at any one time. The first electric block system was installed in 1879 on the double track between Sydney and Newtown.[15]

Aside from the safe working, the correct time was essential for passengers to coordinate their own arrivals and departures. Although there is little concrete information about the first system of clocks for the original Sydney terminal, when the second Sydney terminal building was opened in 1874, an elaborate system of clocks and timekeeping was in place.

The station had five clocks installed, each built by clockmaker Angelo Tornaghi: a central clock and two pairs of clocks at each end of the station. Tornaghi built the clocks as an integrated system, with the pairs connected to the central clock by wire, one to each pair, which meant all clocks displayed the same time. His mechanism avoided the need for a bulky working mechanism to be fitted to each set of clocks and allowed them to be placed back-to-back and be flush to the wall they were fitted into. In June 1874, Tornaghi repaired the clocks when they were found to be running irregularly. The problem was not with the clocks themselves, but caused by swallows building

Figure 5: Sydney Observatory in 1901 showing the time ball in the dropped position on the Observatory tower (Source: State Records NSW)

12 Fraser, D (ed), *Sydney From Settlement to City: An engineering history of Sydney*, (Engineers Australia Pty Ltd, Sydney, 1989), p. 68

13 Pickett, C., & N. Lomb, *Observer and Observed: A Pictorial History of Sydney Observatory and Observatory Hill,* (Powerhouse Publishing, Sydney, 2001), p. 22–23
14 Davidson, op cit, p. 53
15 Fraser, op cit, p. 74

their nests on the wire system that connected the clocks to a central master clock. Early photographs of the Sydney terminal show one of Tornaghi's clocks in the gabled end of the main platform building. Tornaghi's system also controlled the illumination of the dials via gas lights at night. The clock mechanism increased the flow of gas in the evening to light the clock face and lowered it in the morning.[16]

Away from Sydney terminal, private contractors tendered for the job of maintaining and winding the clocks on the various lines. John and Samuel Hardy, clock and watch makers of Sydney, were commissioned to repair and regularly wind the 13 clocks on the Great Southern and Great Western lines in May 1861 for an annual fee of £25 paid in quarterly instalments.

In 1863 Charles White Williams of Newcastle won a similar tender for the clocks on the Great Northern Railway and in 1865 William Hayward won the tender to wind and keep in repair the clocks and the guards' watches for the Great Southern and Western Lines including the Richmond and Windsor extensions.[17]

In July 1876 a new electric clock was installed at the Sydney terminal with a telegraphic wire connection back to the Observatory. The Observatory sent an electric signal to the railway on the hour each hour and the clocks were automatically adjusted to read the correct time. If the railway clocks were too far out for the electric signal to readjust them, an alarm would sound allowing for station staff to reset the clocks.[18] This system was the forerunner to the impulse clock system installed through the rail network in the 1920s. Despite the ingenuity and effective timekeeping of the clock system at Sydney terminal, extensions to the station in the 1880s obscured the station clocks from the street and entrance. In 1883 an irate traveller wrote to the editor of the *Sydney Morning Herald* to express frustration, saying:

> **"Surely we have waited long and patiently enough to induce the Government to place in a position plainly visible to the drivers and occupants of public vehicles, who may have business at the only terminus of our city by day or night a thoroughly reliable clock such a one as would allow a tram conductor or cab driver to know confidently that a small amount of additional speed would undoubtedly land his passengers at the platform in time, without rush or hurry, to catch the outgoing train."[19]**

Figure 6: A guard's pocket watch (Source: Art of Multimedia)

Figure 7: c1875 photograph of Sydney yard with the main passenger station on the left. Another of Tornaghi's clocks can be seen in the centre of the gable. His dual faced clocks enabled the time to be seen from the platform inside and outside the terminal as well as by those working in the yards (Source: Powerhouse Collection)

Railway time becomes standard time

While accurate time was important for passengers and train staff, there was a greater need for the trains to run on time for safety reasons and this necessitated the standardisation of time along the inland routes that spread out from Sydney and Newcastle.

As the network spread, so too did railway time. It was often the case that a town had more than one source of public time, with clocks at the railway station, a court house, post office or town hall, each showing a variation in the local time, causing confusion and irritation.

The railways, however, enjoyed the advantage that all stations were connected back to the Sydney terminal via the telegraph, so that, as the time ball at Observatory Hill sent a signal to the Sydney station at 1pm, that signal was then relayed to all the stations connected to Sydney. Keeping Sydney time was then written into the Rules and Regulations of the NSW Government Railways. Rule 44 1 (a) stated that "Sydney time must be observed by all Stations, and clocks and watches must be regulated accordingly."[20]

Station masters were charged with maintaining the correct time on the station clocks and making sure each clock was regularly wound and serviced.

Gradually, railway time was recognised by the broader population, or at least by those who lived in towns and suburbs where the railway passed through, to be the correct time. Railway time then became the standard time, from which other public clocks in the area would take their bearings. As Benjamin Barnes notes:

> **Railways had a unifying effect on time, because for the first time you had a mass communication system that was reliable that could be timed to the minute.[21]**

16 *Sydney Morning Herald,* 5 June 1876, p. 5
17 SRNSW NSW Railway Commissioners Correspondence, Series 16348 Items 1861/23, 1863/16, 1865/1
18 *The Sydney Mail and NSW Advertiser,* 8 July 1876, p. 51
19 *Sydney Morning Herald,* 30 November 1883, p. 7

20 New South Wales Government Railways, General Appendix to the Book of Rules and Regulations and to the Working Time Tables, 1927, p. 36
21 Benjamin Barnes, Oral history interview, 11 February 2016

In 1895 each colonial government across Australia voted for a system of standard time based on the international standard of Greenwich Mean Time, introducing a system of time zones across the country to replace the local state times that had been the norm. As with Britain and America, the move to standard time had been due in large part to the spread of the railways and their implementation of a single time across their systems. As the separate rail networks were, in turn, connected at state borders, it became increasingly apparent that a standard time was required.[22] The introduction of standard time was passed by all parliaments, with all clocks reset to show the standard time on 1 February 1895. The ease of the transition was largely due to the gradual permeation of clock-based timetables and routines set down by the expanding railway network.

NSW Government Railway clocks

As correct and accurate time became synonymous with the railways, a number of entrepreneurial watch and clock makers in Sydney began advertising and contacting the railways in an attempt to secure the lucrative contract to supply clocks and timepieces to the railways.

In December 1855, Thomas Edward Rudd, watchmaker and jeweller of King Street Sydney advertised in the *Freeman's Journal* calling the attention of the railway directors, 'where correct time is an object' to his recently imported English eight-day hall clocks, striking bracket clocks and in particular his office dial clocks

with inside steel chains (fusee) made expressly for railway stations. He also had one 'beautiful railway terminus clock, which had to be seen to be appreciated'.[23]

The association of railways and accurate time was also taken up in the advertising of many Sydney clock and watchmakers, whether they supplied timepieces to the railways or not. Watchmakers J.J. Wardell, and Mason and Carloss both had shops opposite the railway in George Street by 1866.[24] Later businesses, such as A. Saunders advertised in the *NSW Railway Budget*, the staff magazine for the NSW Railways, promoting his keyless railway watches and railway lever watches as part of his reliable watch collection, leveraging off his proximity to the railway on George Street and the reputation the railways had for reliable timekeeping.[25]

Watches such as these are an important part of the history of the railways but also the retailers that were around railways. You end up with retailers as close as, let's say Orchards at Orchards corner [corner of George and Quay Street], just across the road from Central, actually trying to attribute quality to their watches simply by the fact it's a high-precision watch as the railways use… So you ended up with the watches being branded, and they branded in various ways that attribute quality from the railways… It doesn't necessarily mean because you have "engineers special watch" [written] on the watch[face], it was ever used by the New South Wales Government Railways or had
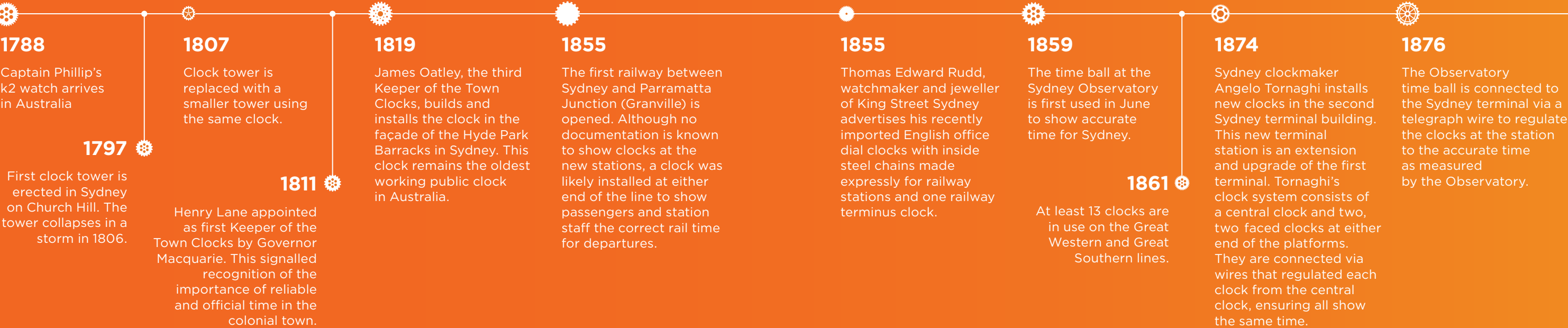
22 Davidson, op cit, p. 72

23 *Freeman's Journal*, 8 December 1855, p. 1
24 *Sands Sydney Directory*, 1866
25 *New South Wales Railway Budget*, 17 October 1894, p. 41

Railway time and chronology

1788
Captain Phillip's k2 watch arrives in Australia

1797
First clock tower is erected in Sydney on Church Hill. The tower collapses in a storm in 1806.

1807
Clock tower is replaced with a smaller tower using the same clock.

1811
Henry Lane appointed as first Keeper of the Town Clocks by Governor Macquarie. This signalled recognition of the importance of reliable and official time in the colonial town.

1819
James Oatley, the third Keeper of the Town Clocks, builds and installs the clock in the façade of the Hyde Park Barracks in Sydney. This clock remains the oldest working public clock in Australia.

1855
The first railway between Sydney and Parramatta Junction (Granville) is opened. Although no documentation is known to show clocks at the new stations, a clock was likely installed at either end of the line to show passengers and station staff the correct rail time for departures.

1855
Thomas Edward Rudd, watchmaker and jeweller of King Street Sydney advertises his recently imported English office dial clocks with inside steel chains made expressly for railway stations and one railway terminus clock.

1859
The time ball at the Sydney Observatory is first used in June to show accurate time for Sydney.

1861
At least 13 clocks are in use on the Great Western and Great Southern lines.

1874
Sydney clockmaker Angelo Tornaghi installs new clocks in the second Sydney terminal building. This new terminal station is an extension and upgrade of the first terminal. Tornaghi's clock system consists of a central clock and two, two faced clocks at either end of the platforms. They are connected via wires that regulated each clock from the central clock, ensuring all show the same time.

1876
The Observatory time ball is connected to the Sydney terminal via a telegraph wire to regulate the clocks at the station to the accurate time as measured by the Observatory.

While local Sydney retailers were busy attempting to profit from the railway's association with accurate timekeeping, the railways were rapidly expanding. From the 1870s until the turn of the twentieth century, there was a railway building boom across NSW with over 1660 station buildings at 1400 locations constructed across NSW during the second half of the nineteenth century. While many 'stations' were simply a platform to board or alight a train, the main passenger stations at larger towns had waiting rooms for passengers and staff facilities, and each had at least one station clock, and in many cases more than one.

Figure 8: An example of a round-faced English style clock. Unusually, this one is marked Wynyard, designating the station it was assigned to (Source: Sydney Trains)

Despite the large number of clocks used across the system, there was no apparent single source of clocks for the railways in the early years. A range of manufacturers were supplying clocks to the Government for use, including English clockmakers such as William Evans of Birmingham, Barraud & Lund and Smith & Sons both from London, all of who made round-faced wall clocks, examples of which remain in the Sydney Trains clock collection. The round-faced style characterised the English clocks.

Before 1885, there were more watches than clocks being used. In correspondence between the Observatory and the NSW Railways on a proposal to make all clocks and watches show 24-hour time, the Railways Clock Inspector noted there were 200 English clocks and 150 American clocks in use (350 total), as well as 40 Frank clocks and 890 watches, of which 269 were being used in the Tramways (then a department of the NSW Railways).[27]

From the 1880s onwards, there was an increasing trend to buy American wall clocks, particularly those made by Seth Thomas. Seth Thomas, a carpenter along with Silas Hoadley began working for Eli Terry in 1806, who operated a clock-making business in Waterbury, Connecticut, until they purchased the company from Terry in 1810. In 1813 Thomas sold out to Hoadley, moved to Plymouth Hollow, Connecticut and set up his own factory where he made tall-case clocks with a patented wooden movement. Thomas continued to expand his business through the middle years of the nineteenth century, making tall-case clocks, wall-mounted clocks and marine clocks.

Figure 9: Blayney railway refreshment rooms c1946 with a Seth Thomas clock on the wall behind the counter (Source: SRNSW)

Following his death in 1859, Seth Thomas' three sons carried on the business first as Seth Thomas' Sons and Company and then, as Seth Thomas Clock Company after 1868. The factory was the main employer in the town of Plymouth Hollow, big enough that the town was renamed Thomaston in 1875 in honour of Seth Thomas.[28]

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26 Andrew Makernik, Oral history interview 10 February 2016

27 SRNSW NSW Railways Commissioners Correspondence, Letter 28 April 1885, R98 Box 3 Item 1886/6864
28 Tran Duy Ly, *Seth Thomas Clocks and Movements*, (Third Edition Volume 1, Arlington Books, 2004), pp. 35–37

Railway time and chronology

c1880

Seth Thomas Clock Company American regulator wall clocks begin to enter the NSW railway system. Seth Thomas clocks come to be the main public wall clock in the NSW Railways, with thousands imported for use between c1880 1914. Seth Thomas clocks are characterised by their octagonal face and long drop case to house the pendulum mechanism. Other clocks in use are primarily from different English makers. Most of these feature a round face and an internal fusee winding system

1885

Railways have 200 English clocks and 150 American clocks in use (350 total), as well as 40 Frank clocks and 890 watches, of which 269 are being used in the Tramways department.

1895

Standard time is introduced in Australia, creating time zones. Standard time had been developed as an extension of railway time, as had already occurred in Great Britain and the USA.

1906

New Sydney Central Railway Station Stage 1 is completed and opened. The new building is built to the north of the earlier station complexes. Its design includes a large clock tower to be built as Stage 2. The new station features a large, suspended clock on the concourse which becomes a popular meeting point for travellers. Clocks are also prominently displayed on new indicator boards and on the platforms.

1921

Sydney Central clock tower is completed. The clock begins working at 10.22am on Saturday 12 March 1921. The clock is connected to the impulse system which operates many of the network clocks. The system works via an electrical impulse sent twice per minute that moves the hands of the connected clocks simultaneously, ensuring accurate time across the network. The master clock for the network is installed in the Prince Alfred sidings at Central Station.

Andrew Makernik, master clockmaker believes the company's success was a product of its size and business model:

It's thought that the first ones [clocks] that arrived into the railway system come out of England... I think very rapidly, though, with the expansion of the railway system... they would have been looking for a standard clock to run all the different things; from refreshment rooms through to the stationmasters' offices, to platforms. So my feeling of the way it occurred is they [NSWGR] probably tried competition and they went to the American supplier because at that point in time, this is the late 1800s, there was a very strong industry in America producing a good-quality clock at a reasonable price.[29]

Seth Thomas won the tender to supply the NSW Government Railways with mechanical station clocks, also known as schoolhouse clocks due to their widespread use in American schools in the same period. The NSW Government Railways favoured the use of two wall clock types: a 31-day regulator wall clock (or drop octagonal clock so named for its octagonal casing and long drop underneath to accommodate the pendulum) and a smaller hexagonal clock with a 7-inch dial and no pendulum box. The mechanism of the pendulum clock differed to the working mechanism of the English round-face clocks which employed a fusee-winding system. In the fusee system, a fine cable or cord regulated the mainspring inside the clock, allowing for very accurate timekeeping.

From the 1880s until c1914, hundreds of Seth Thomas clocks were imported from America and were installed through the system, with each clock being given a small brass plaque inscribed with an inventory number for identification.[30] Although they were not appropriate for display on the platforms, due to their size and light weight, their clear dial made them ideal for use in public waiting rooms and refreshment rooms that were added to many stations across the entire network.

The clocks that we know as railways clocks were generally known as school clocks in America. They were purchased by the railways due to their reliable timekeeping and branded New South Wales Government Railways. I believe that Seth Thomas also [supplied] clocks to other railway organisations [in] India, Canada...[31]

They were also a common feature in station masters' offices, ticket offices, parcel rooms and signals boxes throughout NSW. The clocks were also used by the NSW Tramways, which operated as a division of NSW Railways through the later nineteenth and early twentieth century.

The fundamental benefit of the Seth Thomas clock is that it would only need to be wound about once a month which was really quite an advantage–they're very reliable as a result of that.[32]

Figure 10: A Seth Thomas octagonal long drop case clock, now part of the Sydney Trains clock collection (Source: Sydney Trains)

29 Andrew Makernik, Oral history interview 10 February 2016

30 Bob Cooke, *Wall Clocks of the NSWGR, Australian Journal of Railway Modelling, No.6,* (nd c1993), p. 43
31 Bruce Nelson, Oral history interview, 11 February 2016
32 Andrew Makernik, Oral history interview, 10 February 2016

Railway time and chronology

1926–32

Sydney's underground railway is opened, first between Central and St James (1926) and then from Central via Town Hall and over the Sydney Harbour Bridge to the North Shore line. The new stations are linked to the impulse clock system as far as Hornsby in the north and Parramatta in the west.

1974

NSW Public Transport Commission decides to update the clocks in the network and replace the mechanical clocks and watches with electronic clocks and wristwatches.

1976

The master clock at Central in the Prince Alfred sidings is replaced by a new Patek Philippe system that continues to operate the impulse clocks in the network.

1981

A program is begun to restore the remaining Seth Thomas and other historic clocks for use in railway offices and in public spaces.

c1984

David Hill, Chief Executive SRA, orders a stop to the selloff of historic clocks as the numbers remaining begin to rapidly decline. Remaining Seth Thomas clocks and English round clocks are gradually bought into the Chullora workshops as they are replaced. The collection later moves to the Strathfield depot.

2000

The Sydney Olympics hastens an upgrade of the clock and time management system of State Rail, with the introduction of new LED clocks to stations and new digital indicator boards. These are initially limited to stations along the line leading to Olympic Park and major events.

c2010

Introduction of LED IP clock network, synchronised to a Network Time Protocol (NTP) source or a time server. The NTP means that a system that had traditionally been divided between telling time for the public and telling time for the operational side of the trains network can be reintegrated, so as there is a single time source for both. Public clocks and operational clocks now both show 24 hour time.

2014

The Central clock tower is taken off the impulse system and fitted to a GPS system operating on the NTP network.

During World War I, time recorders or bundy clocks were also introduced to the railway system. The idea of clocking on and clocking off for work was a new one at the turn of the twentieth century, one tied to the growing industrialisation of America where the bundy system had developed. Bundy clocks were a new method to organise the workers' day and to drive efficiency on factory floors. Many managers imagined they would improve efficiency by improving productivity, which in turn would reduce stress on the workers and lead to better wages and conditions. For workers, however, the new system was seen as a form of surveillance and a means of reducing the work process to deadening routine with every minute watched and accounted for.[33]

In July 1917, the introduction of a card-based, bundy clock system into the railway and tramway workshops at Randwick by the Chief Commissioner James Fraser, precipitated the most bitter and prolonged industrial dispute of World War I. The Great Strike which began in the railways, soon spread across large sections of the transport and fuel industries of NSW and lasted 82 days. Until 1917, workers had been left to book their own time against tasks, with the department then calculating the cost of a particular service. The strikers worried that the card system was aimed at speeding up work, something

Figure 12: A time recorder clock held in the clock collection. Time recorders and bundy clocks were introduced to the railways after World War I following the general strike which began as a protest against their introduction (Source: Sydney Trains)

Figure 11: Bathurst railway refreshment rooms, 1947 with a Seth Thomas clock on the far wall (Source: SRNSW)

they had no power over as the system was a closed system, not open to inspection by the workers themselves. In a hostile workplace, the strikers worried that foremen and supervisors would be left unchecked to organise time and punish those who didn't conform. The strike spread quickly from the Randwick and Eveleigh workshops, to the tramways in Sydney and Newcastle, the engine drivers at Darling Harbour yards, engineers at Clyde and White Bay powerhouses before spilling over into wharf and seamen's unions, the meat trade unions, gas employees, carters and trolley men and other associated industries.[34]

Despite the unrest, the card system was eventually introduced and by 1936 there were 102 time recorders in the NSW railways.[35] At least one time recorder survives in the heritage clock collection of Sydney Trains.

Clock maintenance

Clocks travelled around the network as much as some passengers. Although Seth Thomas clocks were reliable, only needing to be wound every 30 days, they did need regular maintenance.

When clocks needed to be serviced, a value sticker was placed across the face or on the case by a railway officer-in-charge and then handed to a guard of a Sydney-bound train, with each staff member who handled the clock having to sign off for its receipt and transfer. In later years specially designed carry bags were made to lessen the damage during transit on their way to and from the workshops in Sydney. Clockmaker Andrew Makernik notes that:

> Strathfield was a central point for clock maintenance and there was a workshop especially for them. They used to transport the clocks in custom-made sleeves, particularly the Seth Thomas clocks from that point to the various stations and offices... [36]

A replacement clock would be forwarded to the station at the same time, ensuring no gap in the time service provided. The result of this work method was that no one clock was permanently assigned to a particular station, but rather they travelled around the network as they were repaired and sent out again. The work was carried out by the Electrical Branch of the NSW Government Railways. Until the 1960s the workshops were at Chullora before moving to Strathfield. Andrew Grace recalls that:

> When I started over at Strathfield in 1990 there was a dedicated clock mechanic there who overhauled all the mechanisms and did all the maintenance full time... When he retired the electronics department took over the maintenance of the clocks.[37]

As well as clock maintenance, the Strathfield depot also repaired the cases for the clocks and built new ones when required. In particular, new doors were often needed and glass bezels. A surviving card system that records the movement of the clocks around the network, including the clock number, its maintenance and the stations it was used at, forms part of Sydney Trains clock collection.
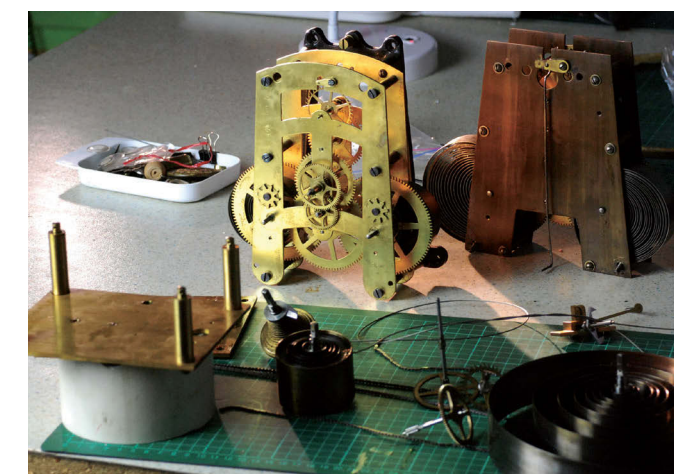

Figure 13: A mechanism from a Seth Thomas Clock, removed for cleaning and maintenance by Doug Minty. When clocks were sent to the railway workshops, the cases were often returned to the station with different components inside, salvaged from other clocks to save time in the return of the clock (Source: Art of Multimedia)

33 Davidson, op cit, p. 128
34 *The NSW Strike Crisis, 1917: Report prepared by direction of the Hon. The Minister for Labour and Industry by the Industrial Commissioners of the State,* (Government Printer, Sydney, 1917), pp. 7A–8A; 37A
35 SRNSW, Series 15253, Annual Reports Electrical Branch 1937–1950

36 Andrew Makernik, Oral history interview, 11 February 2016
37 Andrew Grace, Oral history interview, 11 February 2016

Clocks sent to the clock workshops at Chullora or Strathfield, were often repaired with spare parts from other clocks, resulting in a mixture of workings and mechanisms inside the cases. As each part was individually numbered, clocks being restored in recent times for the railways or for private collectors often display a combination of parts and pieces. Master clockmaker Doug Minty has seen many with multiple components:

Figure 15: A large platform clock now at Central (Source: Sydney Trains)

Figure 14: Plans for a case to fit a Seth Thomas octagonal long drop clocks. The cases were often made or repaired at the Strathfield depot as part of the ongoing clock maintenance (Source: Sydney Trains)

38 Robin Hedditch, Oral history interview, 11 February 2016

Figure 16: Singleton railway station c1900 showing the railway staff on the main platform. To the right of the picture, the reflective round face of a large platform clock is clearly visible hanging on the station wall (Source: SRNSW)

Figure 17: A large platform clock at Maitland station, date unknown (Source: ARHS)

Figure 18: A carry bag for a Seth Thomas clock, now part of the Sydney Trains clock collection (Source: Sydney Trains)

In addition to Seth Thomas and English-style round clocks, larger platform clocks were also installed at major stations to show time. These clocks had large faces and long drop cases for the pendulum and workings. Their size ensured they were visible not only by passengers waiting or alighting from the trains but also by drivers, guards and others working on trains passing through a station. As stations developed and platforms were extended and covered over, medium-sized, double-faced clocks were often installed under the rafters of the platform to allow waiting passengers to also see the time. An example of a large station clock is on display on the main concourse at Central Station and is thought to have originally come from Croydon and reconstructed from spare parts prior to its placement on the concourse in c2005.[40]

39 Doug Minty, Oral history interview, 10 February 2016
40 Robin Hedditch, Oral history interview, 10 February 2016

Figure 19: The new Central Station concourse in 1906 showing the prominent position of the concourse clock suspended from the roof truss (Source: SRNSWSeries 17420)

Central clock tower

In 1901 an advisory board to the NSW Railway Commissioners began investigations on the construction of a grand new terminal building for Sydney.

It was decided that the new station, designed under supervision of the Government Architect Walter Liberty Vernon, would be big enough to meet the growing demands of the expanding railway network and also a grand architectural statement. The chosen design, drafted by assistant Government Architect Gorrie McLeish Blair included a tram interchange, shops, offices, a large train shed and a prominent clock tower for the north-west corner. The new station was to be built to the north of the former Sydney Terminal, which by 1900 had been overwhelmed by the increasing amount of traffic. The location for the new station was on the site of the closed Devonshire Street cemetery, which was moved and whose southern boundary formed the northern boundary of the current Sydney terminal site.

The first stage of the new terminal opened in August 1906, including the grand colonnaded sandstone façade and arcades and a large covered station concourse. The central feature of the concourse was an imposing train indicator board with 20 columns showing train departures. At the top centre of the board, in a decorative scrolled gable was a round-faced clock with clock faces above each indicator column showing the departure times. Suspended from the roof of the new concourse was a second, much larger round clock. This large clock, prominent above the bustling concourse, became a favoured meeting place for commuters and passengers at Central Station and remains the case to the present day.

Work on the second stage of the new terminal began in August 1915, but progress was slow due to wartime shortages and the construction of the proposed clock tower did not begin until 1917-1918. Due to the war and a shortage of steel, the column, girders and floor of the tower were built using reinforced concrete. By mid-1919 the construction of the tower had reached the height of the open colonnaded space directly below the clock room, with the clock room completed by November 1920 when the clock mechanism was installed.

The tower was finished by the start of 1921 and the clock was set in motion at 10.22am on Saturday 12 March 1921.[41]

The clock is reached via a staircase of 272 steps from the concourse to the clock face. The clock has four faces, each 4.8 meters in diameter with the hour hand measuring 2.3 meters and the minute hand 3 meters long. The mechanism is from Gent & Company of England, including the 83kg pendulum with the dials made at the Randwick Tramway Workshops.

The clock was connected to the electric impulse system, with an impulse sent on the minute and half minute. To move the hands forward the mechanism disengaged the pawl within the mechanism at 27 seconds to 29 seconds, stopping the hands until the pulse on the half-minute allowed the pawl to reconnect with the ratchet wheel and move the minute hand. Due to the scale of the clock and the height of the tower, the two-second stoppage was

41   McKillop, R, Donald Ellsmore and John Oakes, *A Century of Central: Sydney's Central Station 1906-2006*, (Australian Railway Historical Society, NSW Division, Sydney, 2006), p. 45

Figure 20: The new Central Station indicator board with a clock at the top to show time and to give indications of the time till departure through comparison with the clock faces above each board (Source: SRNSW Series 17420)

imperceptible from below. The clock face was illuminated, meaning the clock could be read easily day or night. The completed tower, which reached 85m above street level quickly became a city landmark. It became known colloquially as the 'working man's watch', because of its prominent position and the ability to see it from a distance particularly in the southern end of the city and the industrial southern suburbs.[42]

The height of the tower and its exposed position meant that the clock itself was affected by the daily weather conditions, which could in turn affect the time shown. Wind was a particular problem.

One of the biggest problems we have with the clock is an inbuilt protection mechanism in the clock called lash effect. Lash effect is where you have winds that have the potential to put strain on the dial trains. Lash effect allows for movement of those dial trains up to 2 minutes... that can allow the times to vary at high winds and show an inaccurate time. One of our problems is complaints from the customer or the CEO to say that the clock is inaccurate and we would adjust the clock only to have the winds drop and we'd have to come back and adjust the clock again.[43]

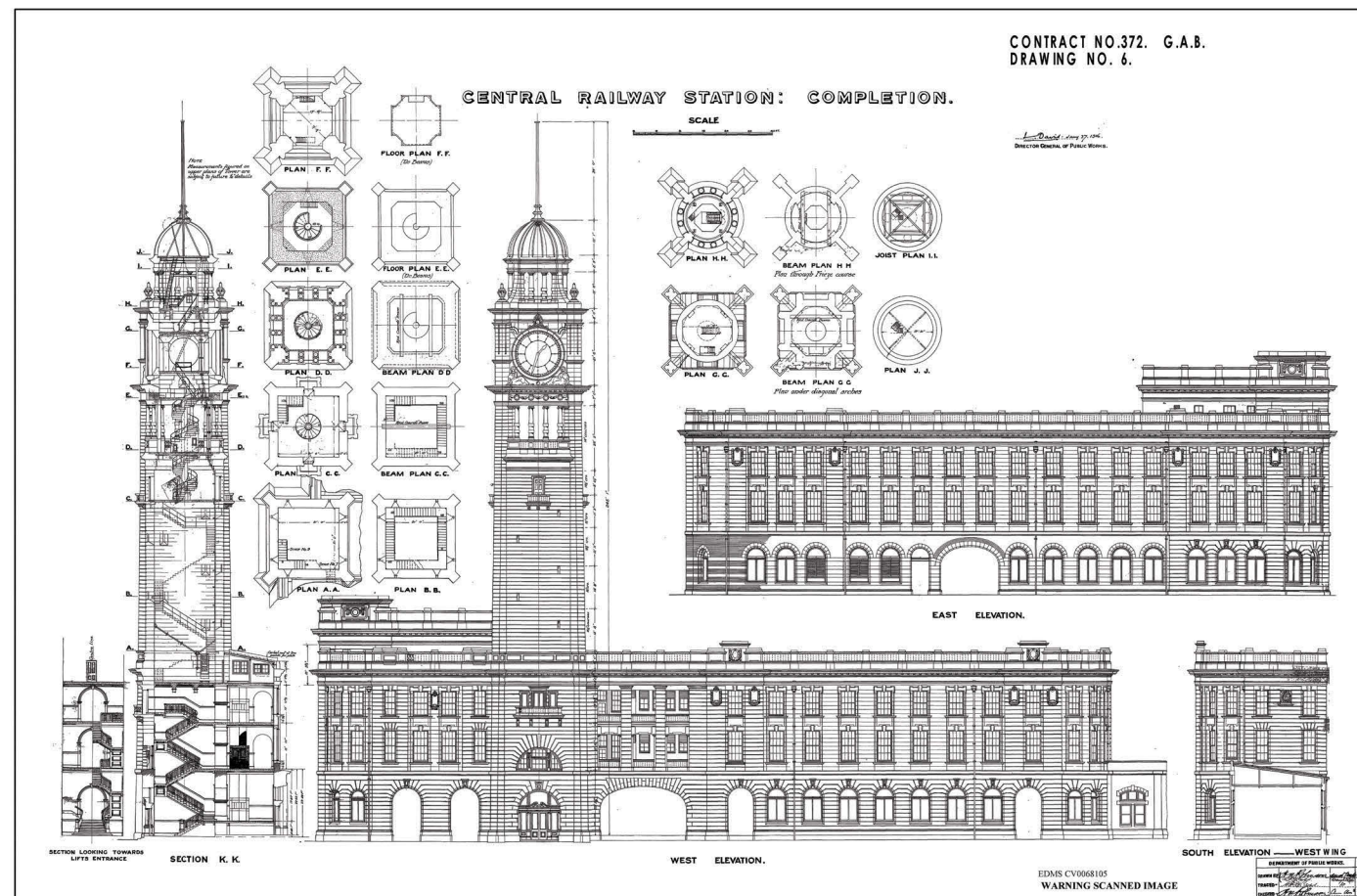**Figure 22:** Workers begin to construct the clock room, 1920 (Source SRNSW)

Figure 21: Plans showing the arrangements for the new Central Station including the clock tower, 1920 (Source: Sydney Trains)

Figure 23: The clock tower under construction, 1919 (Source: ARHS)

42 Oakes, J, *Sydney's Central (2nd ed),* (Australian Railway Historical Society, NSW Division, Sydney, 2012), p. 31; McKilop op cit, p. 64

43 Matt Rudland, Oral history interview, 12 February 2016t

Matt Rudland, who was responsible for maintaining the clock was aware of the time variations due to wind and the lash effect, and more so the physical needs required to attend to the issue:

> Prior to the GPS system being installed it was very labour intensive to adjust the clock... I would be required on occasions to visit the clock up to five times. I would have to adjust the clock and then go down, and I'd have to check the clock and come back up do another adjustment, go back down, check it again. I might have to come back in the afternoon because ambient temperatures or high winds have affected the dial trains and again, I'd have to come back up.[44]

The clock was only stopped once a year to allow for the change-over at the beginning and end of daylight saving.

> The tower clock at Central had been in operation from when they originally built it in the 1920s, and it was a very, very clever electronic system and in the 1920s it was quite amazing... These electric clocks were very high maintenance because they generate spark and every time you generate spark you generate carbon and you generate a wearing point, so the maintenance for that clock was very high. They used to employ, as I understand, two people who used to look after the clock and they were there several times a week just to keep it going, to make sure it operated, kept beautiful time, worked very well, and did the job that it was required to.[45]

Over time, the steel frames supporting the clock faces rusted and cracked the stonework. In 1985 the clock mechanism was overhauled and the frames attached to an independent support

Figure 24: The original clock hands prior to installation at Central, 1921. These were replaced in 1985 with new, steel hands (Source: ARHS)

inside the clock tower. The hands of the clock were also replaced with new steel hands.

In 2014 the tower clock was disconnected from the impulse system, whose mechanism had deteriorated to a point where it was becoming increasingly difficult to service, and a new GPS clock mechanism was installed. The new system automatically adjusts for daylight saving and has a one-second reliability.

The original Gent & Company mechanism was conserved and kept in place in the tower.
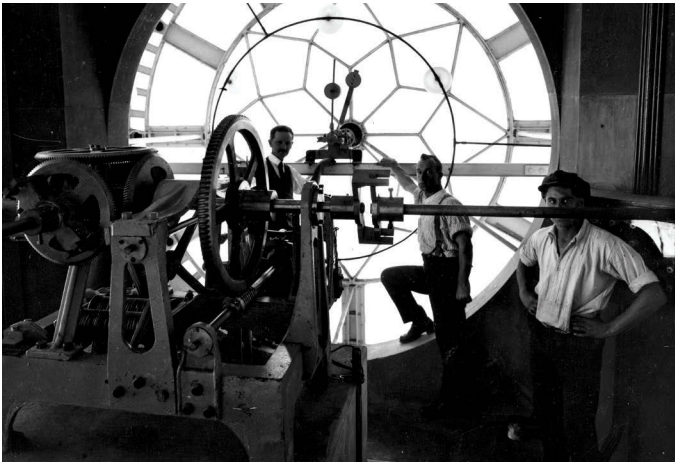

Figure 25: The completed clock room prior to the installation of the clock, 1920 (Source: SRNSW)

Figure 26: Installing the clock into the tower in late 1920. Note the mechanism in the foreground with the driving arms extending to each of the dials (Source: ARHS)
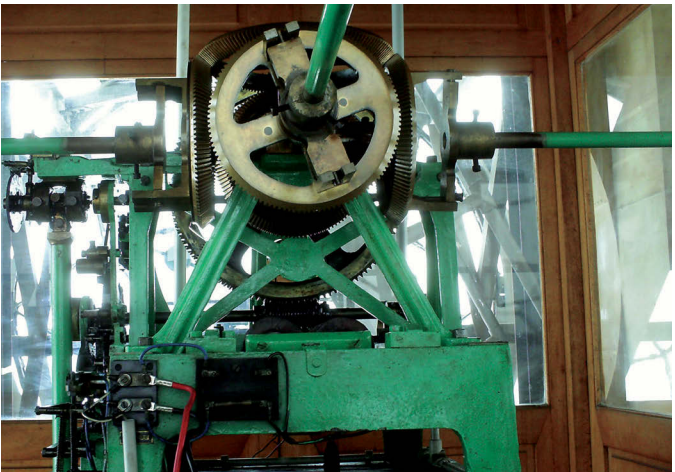

Figure 27: The original 1920 mechanism for the Central tower clock. Although disconnected from the impulse system in 2014, the workings were restored and conserved within the clock tower to maintain the historic connection and understanding of the clock and how it worked (Source: Sydney Trains)

Figure 28: Looking through the glass of the Central tower clock face, showing the winding rod that was part of the original mechanism and is still used to turn the hands (Source: Sydney Trains)

44 Matt Rudland, Oral history interview, 12 February 2016
45 Andrew Makernik, Oral history interview, 10 February 2016
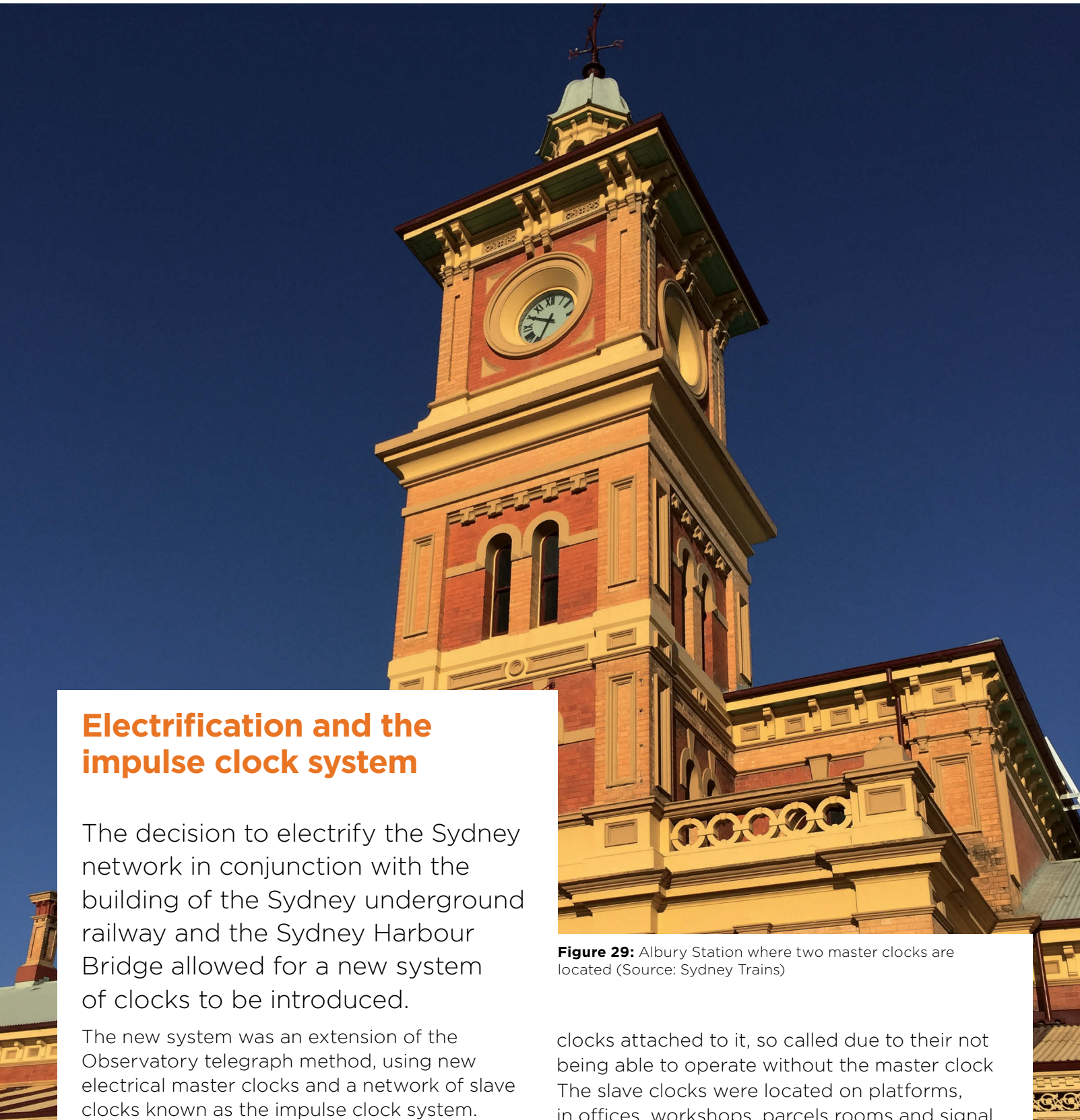
Electrification and the impulse clock system

The decision to electrify the Sydney network in conjunction with the building of the Sydney underground railway and the Sydney Harbour Bridge allowed for a new system of clocks to be introduced.

The new system was an extension of the Observatory telegraph method, using new electrical master clocks and a network of slave clocks known as the impulse clock system. This new method of timekeeping and time display at stations was possible due to the expansion of the electricity network provided by the railways, as electrical power stations and smaller substations were built across NSW.

At the centre of the impulse system was a master clock, a precision clock that provided timing signals across the network. The signals, sent every 30 seconds, synchronised the slave clocks attached to it, so called due to their not being able to operate without the master clock The slave clocks were located on platforms, in offices, workshops, parcels rooms and signal boxes. Within the Sydney metropolitan network there were three known master clocks, the main two located in the telephone exchange in Prince Alfred Sidings at Central Railway and one in Railway House at Wynyard. The annual reports of the Electrical Branch at SRNSW record that there were 14 master clocks in the NSW system each year between 1944 and 1950 when the reports finish.[46] This number included master

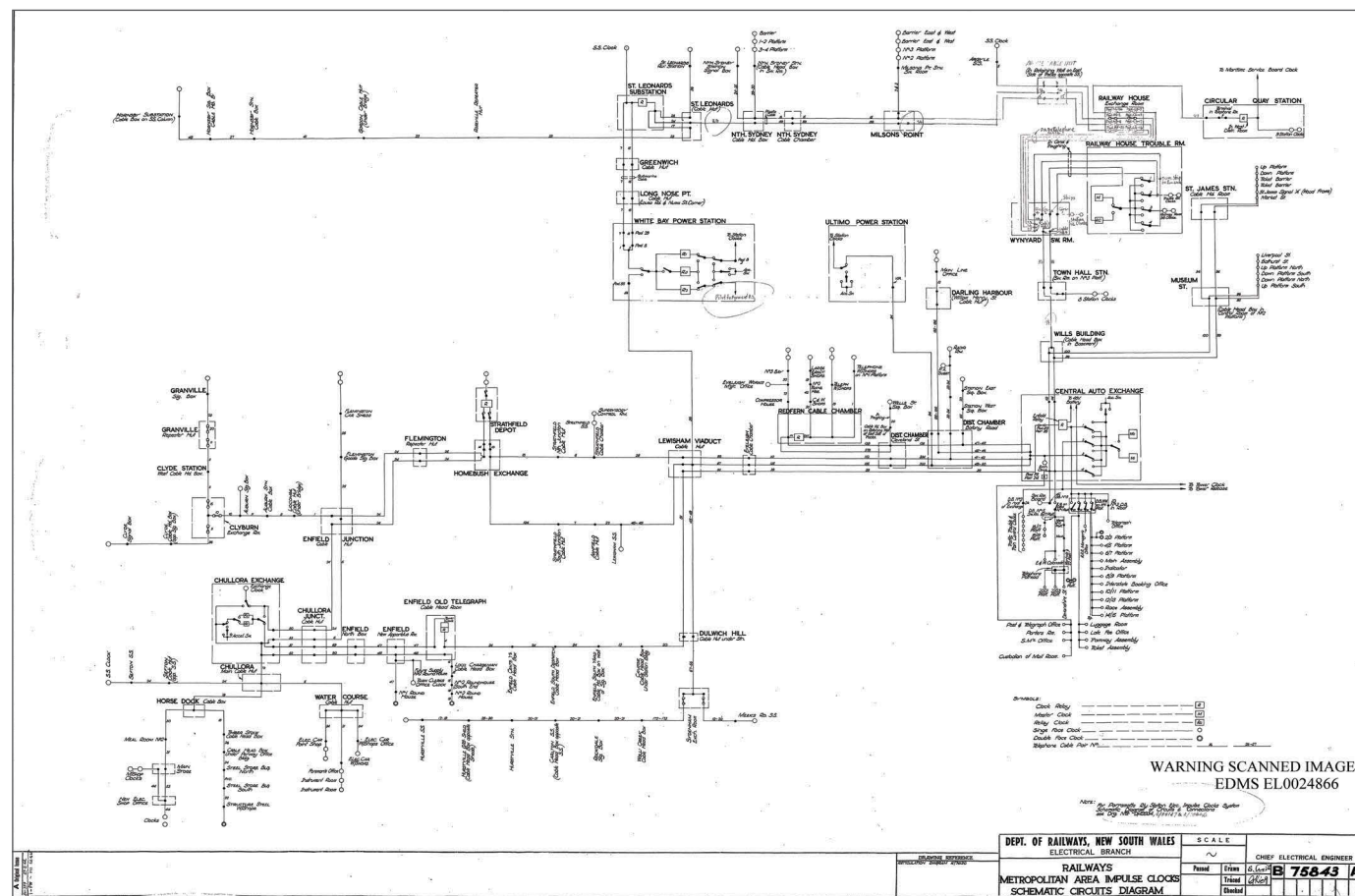**Figure 29:** Albury Station where two master clocks are located (Source: Sydney Trains)

Figure 30: This schematic plan shows the extent of the impulse clock system in the Sydney network in 1962. The master clocks are at Central and Transport House, with relay clocks throughout the system allowing the pulse to reach as far as Hornsby and out to Parramatta (Source: Sydney Trains)
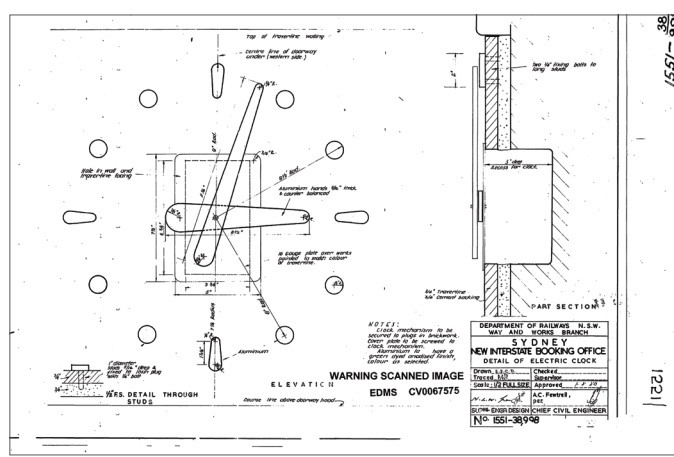

Figure 31: Plans for an electric clock for the interstate booking office at Central, completed in 1951. This clock was connected to the impulse system when finished (Source: Sydney Trains)
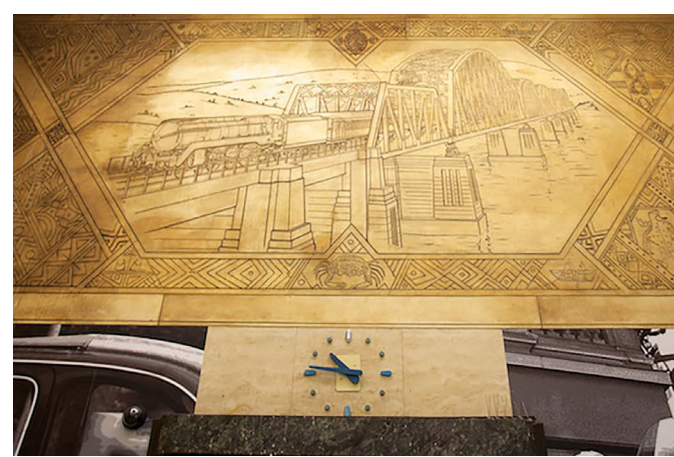

Figure 32: The clock in the interstate booking office at Central. Installed in 1951, it was incorporated into a decorative mural showing aspects of the state's rail network (Source: Sydney Trains)

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46 SRNSW, Series 15253, *Annual Reports Electrical Branch 1937–1950*

clocks connected to different regional networks. For example, two were located at Albury with another in the Zaara Street power station in Newcastle. The location of the remaining master clocks has not been determined, as the records do not give other locations. The master clocks were manufactured by a company called Timatic. As the system was expanded clock relays were also installed to act as a repeater circuit to drive the clocks from a local battery at each distribution location. Repeater stations or clock relays were installed at the Chullora exchange, Strathfield depot, Redfern, St Leonards, Parramatta and Circular Quay as well as Railway House at Wynyard and the tower clock in Enfield Yards. Alarm circuits were installed to sound if the incoming pulse was interrupted at any stage and so alert the station staff to the problem. The largest clock fitted to the system was the Central tower clock.[47] The system, while running electrically, could still be manipulated manually via the master clock. This was necessary if there was a fault or a cut in power and at the beginning and end of daylight saving.

> At daylight saving, the master clock had to be changed at 2 o'clock in the morning either to be set back an hour or forward an hour, and for the tower clock, we would have to climb up and manually set it forward on the daylight saving. It was essential to do it at 2am in the morning as there were no trains running at that time.[48]

In c1976 the old Timatic master clocks at Central Station were replaced by two new Patek Philippe Modular Integrated master clocks, installed at Prince Alfred sidings. Patek Philippe's very first master clock system was installed in 1968 at the newly-

Figure 33: A 'Timatic' master clock, the same as was originally installed at Prince Alfred Sidings, Central station, as well as at Transport House and other master clock locations. Two such master clocks (thought to be from Central) are now held in the historic clock collection of Sydney Trains (Source: Sydney Trains)
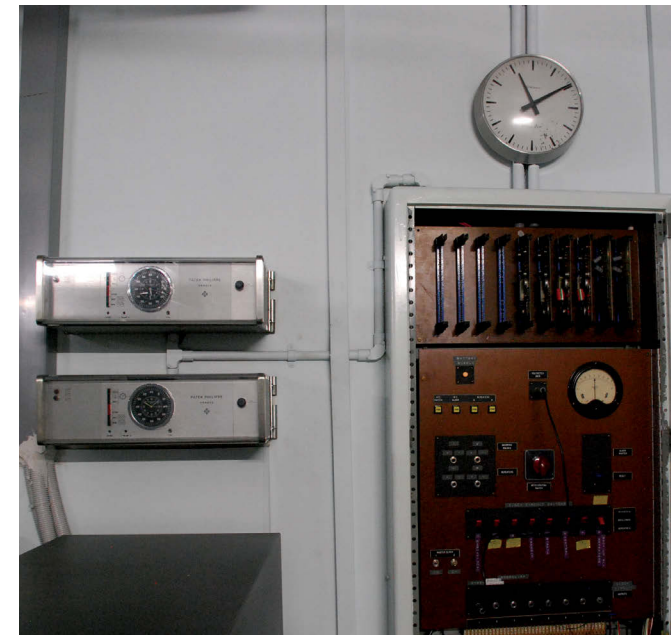

Figure 34: Two Patek Philippe modual master clocks, seen here on the left, replaced the old Timatic master clocks at Central in 1976 (Source: Sydney Trains)
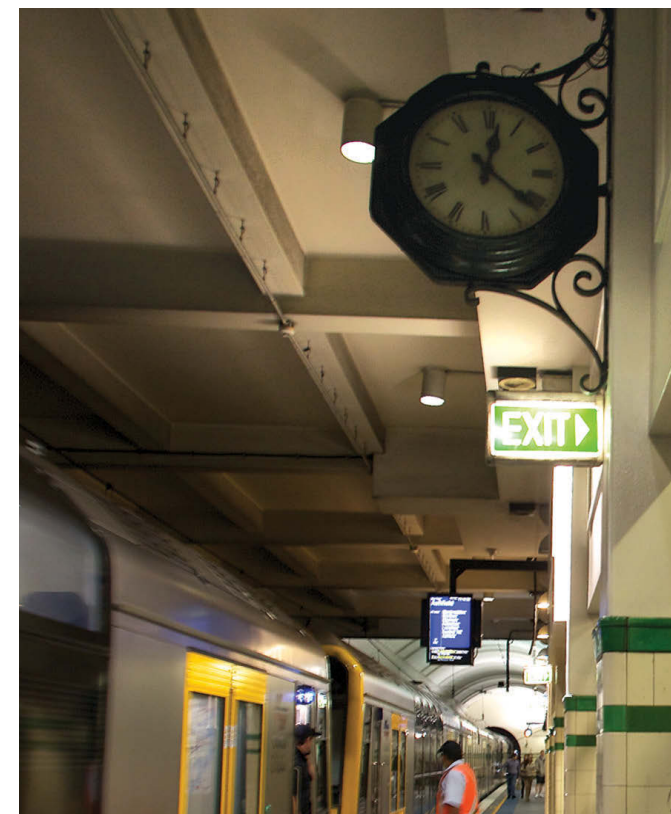

Figure 35: Enfield Yard clock tower. This tower clock served the Enfield Yard as well as being one of the clock relays for the impulse system (Source: ARHS)

opened Geneva-Cointrin airport terminal in Switzerland, and is precise to 1/10,000 of a second.[49]

The master clock, which was considered the best of its type at the time, continues to run the remaining impulse clocks in the Sydney Trains network, most of which operate at Central Station and on the Sydney underground system.

Those that remain in use now operate side-by-side with modern digital and LED computer-operated clocks and time pieces, many now incorporated into the electronic passenger information displays. It is these new systems that now determine the time for the public, with many of the older clocks used as heritage pieces in stations.

> The impulse clock system works separately to the NTP [Network Time Protocol] servers—it just sends the 50-volt pulse out to the slave clocks at the stations that are in the City Circle. There is no actual connection to the other systems, its completely independent of the other systems for the digital clocks.[50]

Figure 36: Suspended platform slave clock still in place at St James station (Source: Sydney Trains)

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47 Sydney Trains Clock File, 'Department of Railways NSW Electrical Branch auto telephone exchange-Sydney station electric clock control: Instructions for officer in charge
48 Andrew Grace, Oral history interview, 11 February 2016

49 http://www.patek.com/en/company/history
50 Craig Walton, Oral history interviews, 11 February 2016

Current time systems

In the lead up to the Sydney Olympics in 2000, a major upgrade of rail time systems was implemented to cope with the expected crowds using the trains.

Fast and accurate time telling was needed to deal with the large crowds, and the older system of impulse clocks, electric clocks and manually operated indicator boards were no longer adequate.

New passenger information systems were introduced along the lines between Central and the Olympic Park at Homebush to assist with traffic movements. Included in the overhaul were new plasma indicator boards, otherwise known as Passenger Information Displays (PIDs), which included a clock on each and Digital Precise LED clocks on platforms for the train guards, known as the precise clocks system or the LED Serial Clock System.[51]

Figure 37: The old and the new. The suspended concourse clock was installed in the first stage of Central Station in 1906, while the new electronic passenger information board was installed in 2015. (Source: Art of Multimedia)

The first installation was at Martin Place… as the first pilot installation for the Olympics preparation and then rolled out to approximately 15 major stations that were identified as critical to the Olympic work. [52]

With guards then stationed in the middle and end of trains, two LED clocks were placed at the corresponding section of the platforms. However, as both systems were designed for different purposes, that being the public-facing clocks for passengers and the LED clocks for guards, they also displayed the time differently: a 12-hour cycle for passengers (ie: am and pm) and 24-hour time for guards.

The aim was to provide a highly readable, highly accurate clock for the guards so that when they're at a station they had a high level of confidence in the time; so that they could leave the station on time… 24-hour time originally [was] for operational purposes, 12-hour time for passengers. So, on our indicators we were displaying 12-hour time, and on those clocks it was 24-hour time. More recently, in the last few years, the decision has been made to use 24-hour time for all purposes. The precise hour clocks have grown and spread into a variety of places and we now have 600.[53]

The new LED clocks were integrated with the Telstra network, marking a break from the impulse system as the main form of time maintenance. However, the principle was the same, with a master clock on each station (up to 80 stations) connected to the Telstra

time server which took the time and then synchronised the slave clocks on the platforms once every 24 hours.

The original LED Olympic system was further upgraded in the mid-2000s with a new LED IP (Internet Protocol) clock network. This system consisted of an intelligent IP clock which was synchronised to a Network Time Protocol (NTP) source or a time server. NTP is an internet time protocol that serves to synchronise clocks within a computer network.

We do have an issue where the clocks need to be on time because we have a lot of customers who will turn up on a platform and look at a clock, and then if the clock isn't the same as the digital clock then they have issues. So, when we do install a clock we do need to make sure that we can maintain its accuracy.[54]

51 Alan Topfer, Oral history interview, 11 February 2016; Paul Bugeja, Oral history interview, 11 February 2016
52 Alan Topfer, Oral history interview, 11 February 2016

53 Alan Topfer, Oral history interview, 11 February 2016
54 Craig Walton, Oral history interview, 11 February 2016

The introduction of the NTP meant that a system that had traditionally been divided between telling time for the public and telling time for the operational side of the train network could be reintegrated, so there was a single time source for both. This led to the further introduction of LED clocks along station platforms and the transition to 24-hour time displays for all.

Figure 38: An example of the first generation of electronic platform information boards at Epping with the actual time and departure times visible on the screen (Source: Sydney Trains)

Figure 39: An LED clock at Town Hall station alongside one of the new generation of passenger information display screens. The NTP system means now all public-facing and operational clocks are synchronised, lessening any confusion for passengers and staff (Source: Sydney Trains)

The IP clock system is implemented now for all new installations. The original intent of the LED clock network was for customer information. It's progressed for operational purposes so you'll see those clocks located now in the rail management centre, the structure control centre, and it's even migrated over to offices.[55]

Time synchronisation is achieved through a Traceable Network Time (TNT) synchronisation connection on both the Passenger Information Display network and the Digital Precise LED clocks via a centralised time server, which derives its timing information from Global Positioning Systems (GPS) clocks. The time is then distributed down the system via servers, ensuring synchronised time across the digital network.

There was a requirement for Sydney Trains and its predecessors to have a consistent time source, and that came out of observations at Waterfall where there were different times noted during the investigation. Sydney Trains (or RailCorp.) implemented a centralised time network, it's called the traceable time network. What that consists of is what I call Stratum One time service, and also Stratum Two service, stratum meaning how far away, what step away it is from the original time source or UTC time... Each of our Stratum One time servers have a GPS antennae receiver. If those GPS antennas fail, they have a rubidium crystal in them which maintains the time accuracy. This system is used by any computer network to ensure that the time is correct and accurate.[56]

Figure 40: Pocket watches were as essential to the running of the railways as the station clocks themselves. (Source: Art of Multimedia)

Numbers of clocks and watches

With time being a central feature of both safe working and passenger information, there have always been large numbers of clocks and watches deployed across the network from its earliest days.

Numbers can only be approximated for the first decades of the railway due to a lack of information. By the twentieth century regular surveys began to reveal the numbers of clocks and watches in use.

In 1938 there were 196 electrical impulse clocks attached to the network and a further 125 electrical synchronous clocks, with an additional 2,670 mechanical clocks, mainly Seth Thomas clocks and 5,038 watches.[57] By 1941 this had risen to 2,729 mechanical clocks, 109 time recorders, 52 tell-tales, 12 electrical master clocks, 209 impulse clocks, 180 synchronous clocks and 4 signal box clocks.[58]

By 1950 there were 265 impulse and 414 electrical synchronous clocks, with a further 3,179 mechanical clocks operating across the entire network as well as 6,365 watches.

In 1974 6,500 watches were in service, alongside 2,800 mechanical clocks (including Seth Thomas and other early designs), 820 synchronous clocks, 220 impulse clocks, 52 electrical time recorders and 16 mechanical time recorders. Some of the watches dated to 1896 while up to a third of the mechanical clocks were in maintenance at any one time.[59]

55 Paul Bugeja, Oral history interview, 11 February 2016
56 Paul Bugeja, Oral history interview, 11 February 2016

57 SRNSW, Series 15253, *Annual Reports Electrical Branch 1937-1950*
58 SRNSW, Series 15253, *Annual Reports Electrical Branch 1937-1950*
59 SRNSW, Series 15253, *Annual Reports Electrical Branch 1937-1950*

Figure 41: Cronulla railway station in 1968 with the small tower and its clock clearly visible (Source: Sutherland Library)
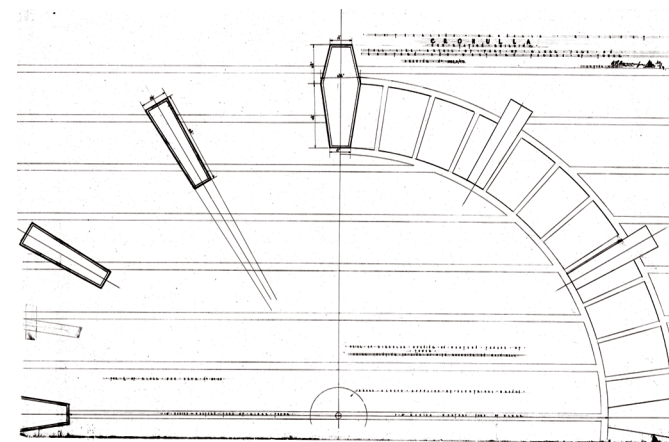

Figure 42: Plan of the clock face for the Cronulla railway station tower, completed in 1939 (Source: Sydney Trains)

Following the review of clocks in 1974 it was decided by the then Public Transport Commission to replace the remaining mechanical clocks with synchronous clocks where practicable. Mechanical time recorders would make way for electric time recorders and that up to 3,000 wrist watches would be introduced to replace the older pocket watches at a rate of 1,000 per year. The change-over was intended to save on maintenance costs as well as providing a better service to customers.

In 1989 an audit of the system showed the almost complete removal of the mechanical clocks. 430 impulse clocks were still working across the NSW network, including the Central tower clock, the clock at Enfield Yard and the tower clock at Albury Station, where there were also two master clocks in operation. In addition, there were 2,500 electric synchronous clocks which included the tower clock at Cronulla Station (installed in 1939 when the station was completed), the large clocks at station platforms and in workshops, digital flip clocks and standard wall clocks, which made up 80% of the total. As well as the electrical clocks, there were a further 2,500 (approximate) battery clocks in service, totalling at least 5,430 clocks.[60]

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60 Sydney Trains Clock Files. Electric clocks in State Rail 1989

Figure 43: A NSWGR pocket watch. These were issued in large numbers to train guards, station masters and other railway employees from the very beginnings of the railways in NSW until they were replaced by wristwatches in the 1970s (Source: Doug Minty)

Figure 45: A selection of former NSW railway pocket watches and their wrist watch replacements, the property of clock repairer Doug Minty (Source: Doug Minty)

Figure 46: An example of a round-faced, English clock used extensively in the NSW railways network. Unlike Seth Thomas clocks, these clocks ran on an internal fusee system which ran for 7–8 days before it needed winding. This clock has a number of individual modifications including the addition of 24-hour time markers on the face and the reminder to wind it Mondays. Note the identification number on the brass plate at the bottom (Source: Sydney Trains)

Figure 44: Two Seth Thomas clocks that have been branded with later incarnations of the railway organisation, the Public Transport Commission (1972–1979) and the State Rail Authority (1980–2003) (Source: Sydney Trains)

Figure 47: Orange railway refreshment room showing an English round-faced clock on the wall. The use of both Seth Thomas style drop case clocks and round clocks was common through the network (Source: SRNSW)

Collecting and conserving historic railway clocks

With the introduction of new passenger information systems, historic clocks were removed from the operational railway network. These historic clocks are now valued by collectors and railway enthusiasts across Australia.

This decision saw a dramatic loss of clock numbers until the mid-1980s when the then Chief Executive David Hill ordered the stopping of any further sales or the presentation of old clocks to retiring staff. In 1981 a program of restoration for the remaining clocks was initiated, with the intention to restore the working mechanisms and cases so they could be put back on walls in public areas.

Given the monetary value of many railway clocks as collectable antiques, many historic clocks were gradually bought into the workshops at Chullora and then Strathfield where the remaining clocks in service were repaired and maintained. In 1984 there were still over 1600 in service or in for repairs and another 250 in storage.[61]

Figure 48: Part of the display of historic clocks in the Sydney Trains collection. A large platform or station clock is shown here, although its original location remains a mystery. On either side are a range of Seth Thomas octagonal clocks, once common throughout the railway network (Source: Art of Multimedia)

By the early 2000s, there was a growing appreciation for the clocks as part of the broader story of NSW railways. Their place in the development of the network was being recognised and put into context of a broader heritage collection. Robin Hedditch, part of the Sydney Trains Heritage Team notes that:

> State agencies have an obligation to look after their heritage and a lot of people understand heritage to be the heritage rollingstock, the trains, the locomotives and also the significant stations, but a large part of our collection are the small objects and these are very important to tell the story of the railways.[62]

In early 2015 Sydney Trains began its most recent audit of their clocks and moved their remaining historic clock collection from stores and workshops at Strathfield to a secure display room underneath Central station.

Figure 49: Examples of some of the many different styles of clocks employed in the railway system in the nineteenth and twentieth century, including Seth Thomas clocks, round-faced eleccctric clocks, flip clocks and synchronised electric and battery operated clocks (Source: Sydney Trains)

> Previously it [the collection] was clocks just stored on pallets in this room which was rather dirty and grimy, so once we had the clocks out then I proceeded to clean the room and arranged for the shelving and the racking to be installed, and we gave the room a clean good paint, and picked out some interesting clocks to display on the racking as good examples of clocks that had been used by the railways over the years.[63]

A program of trying to locate and register all those surviving clocks was begun with storage space organised in a secure clock display room at Central, with clocks mounted on the walls and the remainder packaged and stacked for preservation.

The Sydney Trains clock collection at Central station is the largest, most comprehensive collection of NSW railway time pieces. The collection includes objects from the late nineteenth century through to the late twentieth century, with different objects representing the changing technology associated with time and timekeeping in the NSW railways. The collection includes examples of many of the known mechanical, battery and digital clocks used in the rail network, with Seth Thomas examples making up the bulk of the collection, and demonstrating their predominance as the main clock type in the NSW railway network for close to 100 years.

61 Sydney Trains Clock Files, 'Historic Railway Clocks Preserved', *Statewide* (Magazine), June 1983
62 Robin Hedditch, Oral history interviews, 11 February 2016

63 Bruce Nelson, Oral history interviews, 11 February 2016

In the collection we have the Seth Thomas mechanical clocks, we have the English mechanical clocks (the round ones), we have some early electric wall-mounted clocks, we have several of the early master clocks that ran the impulse system. We have a selection of clocks that go right up to the 1970s including the quite distinctive flip clocks installed by the SRA in the 1970s, we have bundy clocks as well which allowed people to log on and log off from work. We also include the clock bags as part of the collection and spare parts: hands, winders, glass faces, and everything that we need to manage that clock collection.[64]

The clock collection also charts the changing organisational and corporate structure of the railways. Many of the clock faces are inscribed with the particular department they were first commissioned by, including the NSW Government Railways or the Railways Department which operated until 1972, the Public Transport Commission (1972–1979), the State Rail Authority (1977–2003) and CityRail (1989–2012).

The clocks and watches in the historic clock collection of Sydney Trains are important relics of the development of timekeeping in NSW. The standardisation of time developed by the railways and essential to safe running of the trains, led to a system of regulated timekeeping that extended beyond the railway network into the broader community. The clocks and watches of the Sydney Trains clock collection, represent the public face of a timekeeping regime that revolutionised the way that time was measured and applied throughout Australia. Railway time was vital not just to the railway network but was itself the foundation for the telling of time as we understand it today.
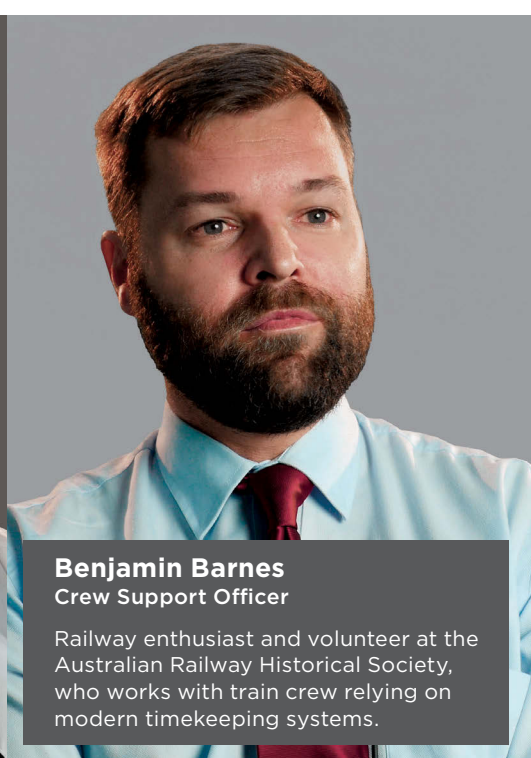

Figure 50: Clock faces on the main indicator board at Sydney Central, 1965 (Source: Photographer Raymond de Berquelle, National Library of Australia)

64 Robin Hedditch, Oral history interviews 11 February 2016
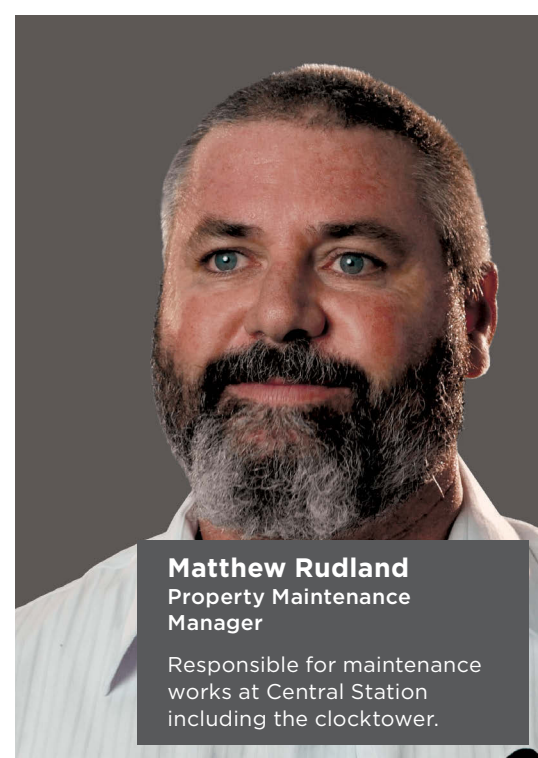
Matthew Rudland
Property Maintenance Manager

Responsible for maintenance works at Central Station including the clocktower.
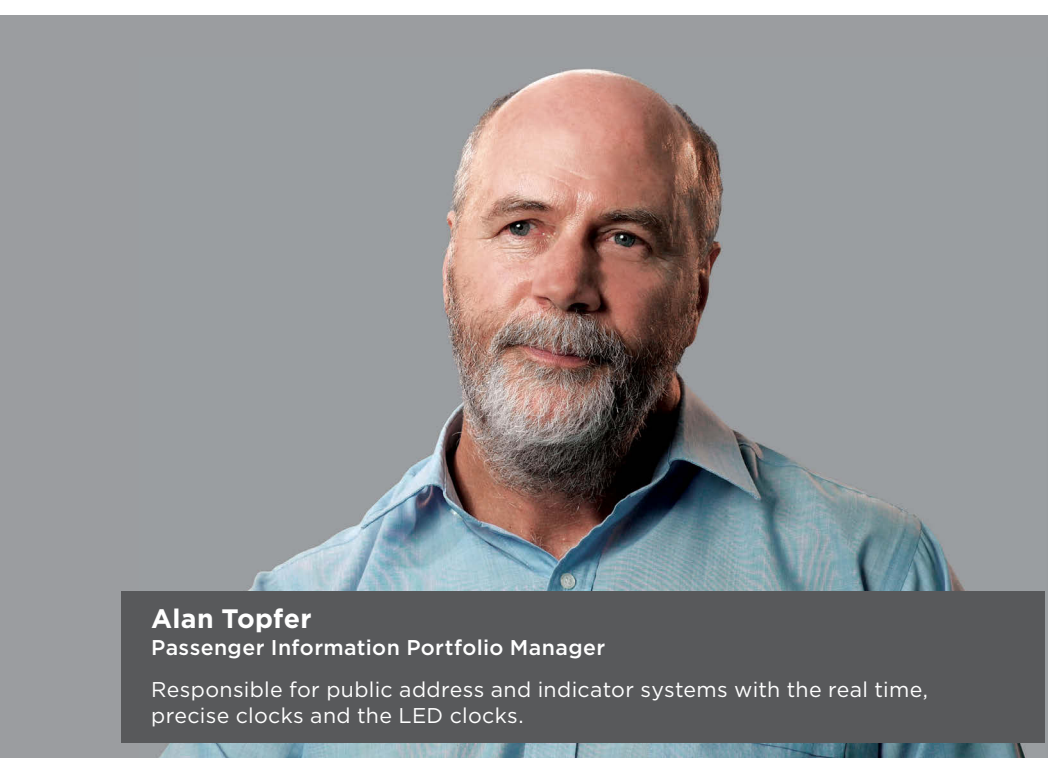
Benjamin Barnes
Crew Support Officer

Railway enthusiast and volunteer at the Australian Railway Historical Society, who works with train crew relying on modern timekeeping systems.
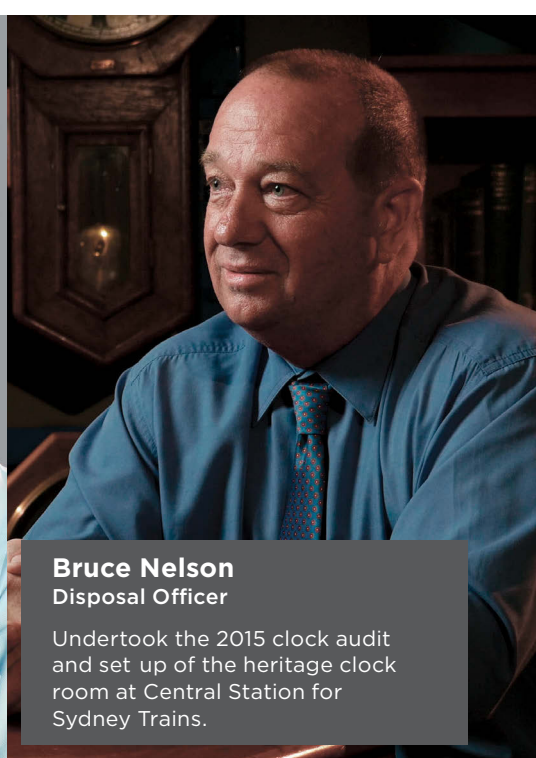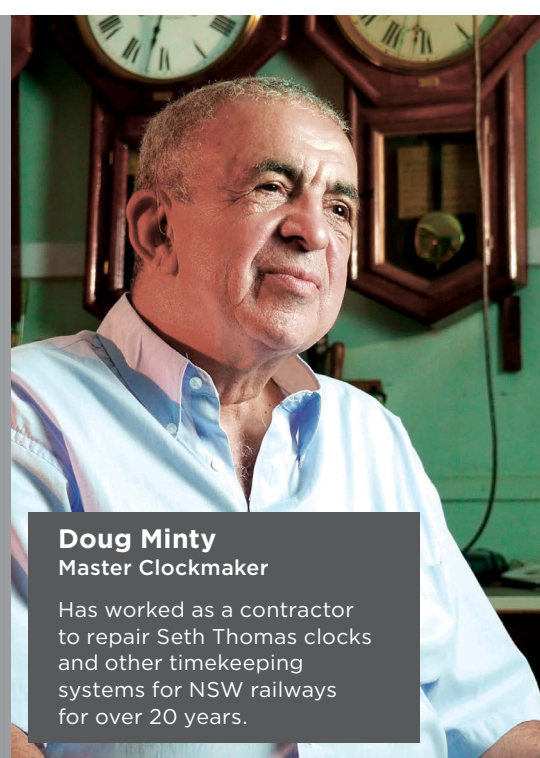
Bruce Nelson
Disposal Officer

Undertook the 2015 clock audit and set up of the heritage clock room at Central Station for Sydney Trains.
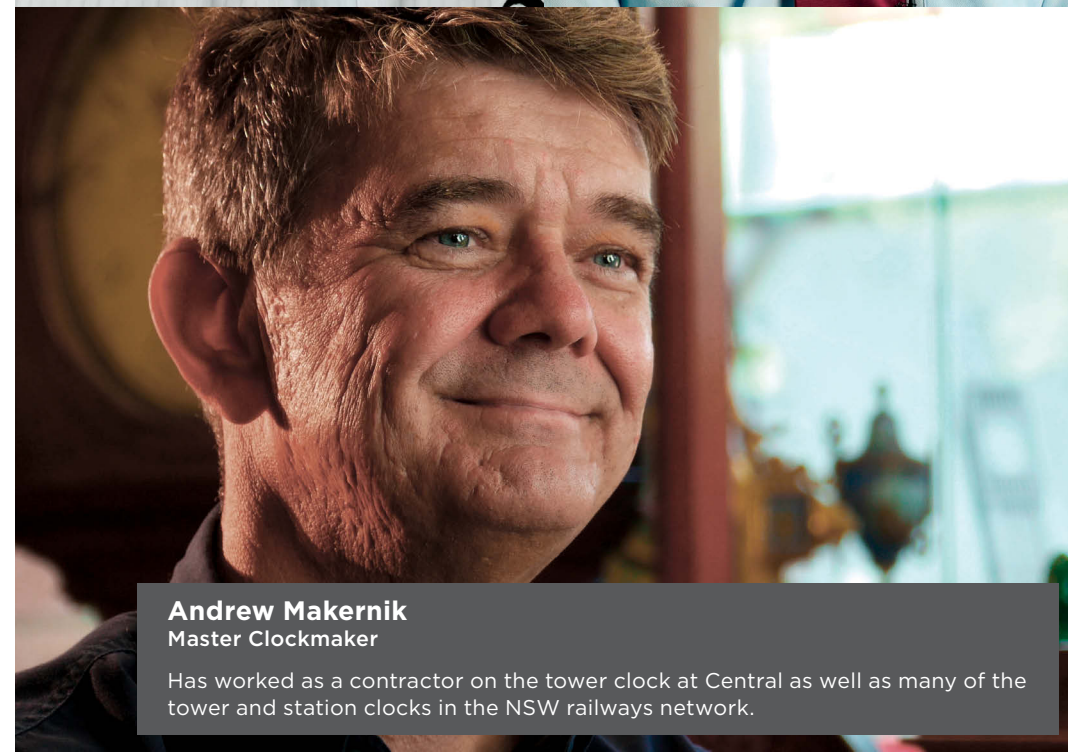
Alan Topfer
Passenger Information Portfolio Manager

Responsible for public address and indicator systems with the real time, precise clocks and the LED clocks.

Doug Minty
Master Clockmaker

Has worked as a contractor to repair Seth Thomas clocks and other timekeeping systems for NSW railways for over 20 years.

Andrew Makernik
Master Clockmaker

Has worked as a contractor on the tower clock at Central as well as many of the tower and station clocks in the NSW railways network.

Dimitar Uzunovski
Clock conservator

Former NSW railway clock repairer responsible for repair works to all clocks across the network including the clocktower at Central.
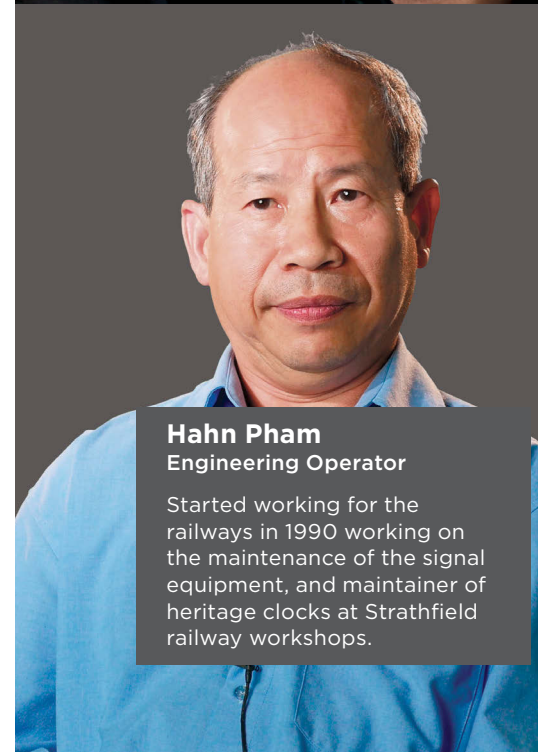
Dave Cleary
Environment Professional

Advises on upgrades or works to heritage listed stations, including reinstatement of heritage clocks.
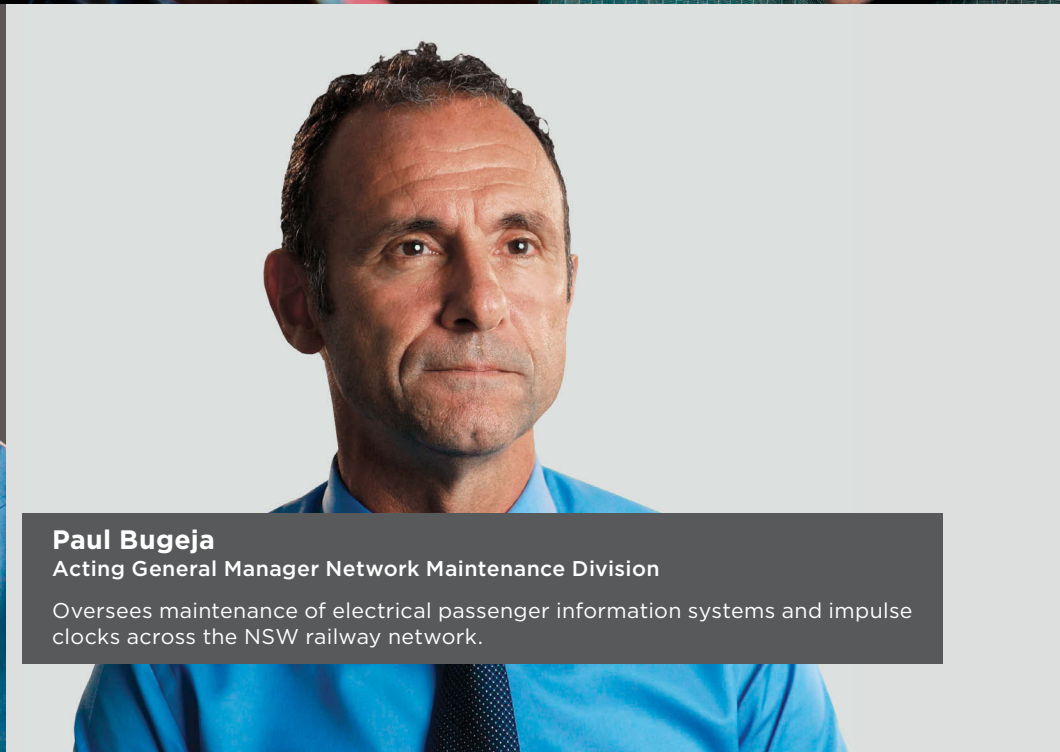
Robin Hedditch
Sydney Trains Heritage Specialist

Manages the movable collection within Sydney Trains, including the historic clock collection.
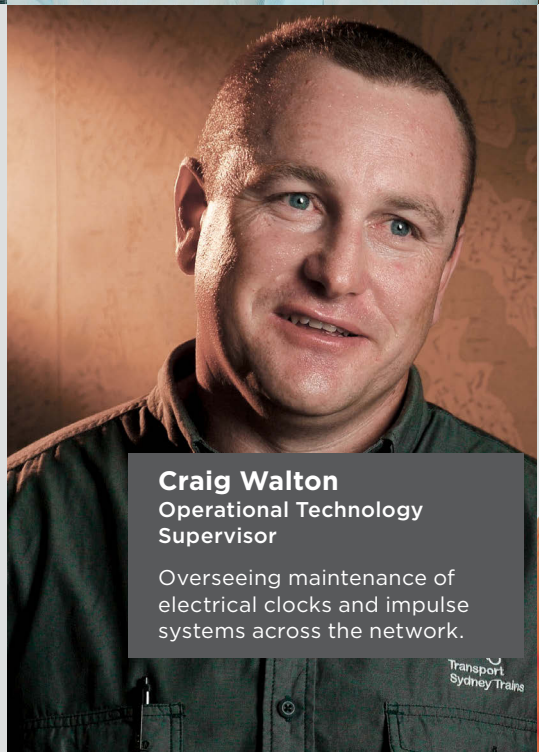
Hahn Pham
Engineering Operator

Started working for the railways in 1990 working on the maintenance of the signal equipment, and maintainer of heritage clocks at Strathfield railway workshops.

Paul Bugeja
Acting General Manager Network Maintenance Division

Oversees maintenance of electrical passenger information systems and impulse clocks across the NSW railway network.

Craig Walton
Operational Technology Supervisor

Overseeing maintenance of electrical clocks and impulse systems across the network.

Andrew Grace
Engineering Operator

Started working for the railways in 1981 as an electrical fitter and ran the store at Strathfield railway workshops which included maintenance of heritage clocks.

Pasquale Di Filippo
Senior Scada Technician Sydney

Maintains 'supervisory control and data acquisition' (SCADA) systems across the Sydney Trains electrical railway network.