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The Engineering of “Engineering a City”.

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SUMMARY: The South Australia Division of Engineers Australia has recently produced a small guide to the engineering heritage of the City of Adelaide. The publication supports the “Looking Back” theme of EA’s 90th year. Although little physical evidence of Adelaide’s engineering heritage remains, the research for the booklet uncovered many more sites than were expected. This paper describes the planning process and provides a brief summary of the heritage aspects covered.

1. GENERAL

About 20 years ago, my colleagues Deane Kemp, the late Dr John Pickles, and Arthur Ward produced *Adelaide - Engineering and Industry* for the South Australian Division of Engineers Australia. It was based on a 20 item Walking Tour devised in 1983 by the Division’s Committee on Engineering Heritage¹.

A few years ago, the Engineering Heritage & History Committee took a new approach. The idea was to organise the information, not by geography, but by the requirements of the community: what engineering infrastructure did those first Colonists need in order to establish their settlement and build their capital city?

2. A BRIEF HISTORY

The Colony of South Australia was proclaimed in 1836. The site for its capital, Adelaide, was chosen on rising ground about six miles from Holdfast Bay where the first settlers had landed (Figure 1). Colonel William Light, the Surveyor General and the Colony’s first engineer, had to lay out a city plan which defined blocks or Town Acres. This pre-planned rectilinear layout makes Adelaide different to other cities which evolved from *ad hoc* settlements.

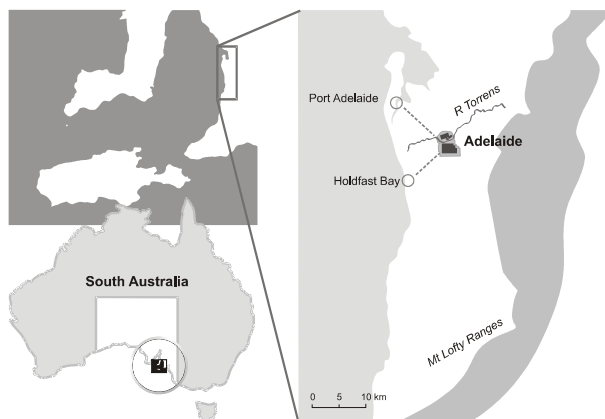


Figure 1. Location of Adelaide

The route between Port Adelaide and the City was a well-travelled one and, not surprisingly, was also the

path followed by the first significant road, the first telegraph line, and the first railway.

3. A HIERARCHY OF NEEDS

In 1943, the American psychologist Abraham Maslow postulated a theory of human motivation². He later developed this into his well-known model of a hierarchy of needs (Figure 2) which states that basic needs have to be adequately satisfied before higher order needs can be developed.

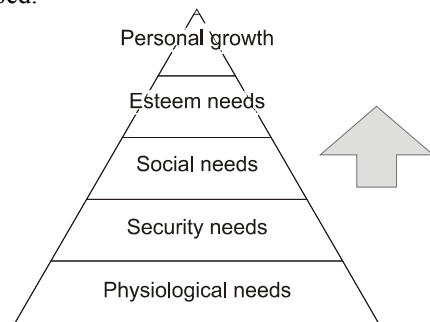


Figure 2. Maslow's Hierarchy of Needs

We realised that the early colonists had a similar pattern of needs (Figure 3). First they had to secure a supply of water and food, build shelters, and find fuel for warmth and cooking. Satisfying these needs required the development of engineering enterprises and infrastructure – water supply, food production, buildings and construction, and so on.

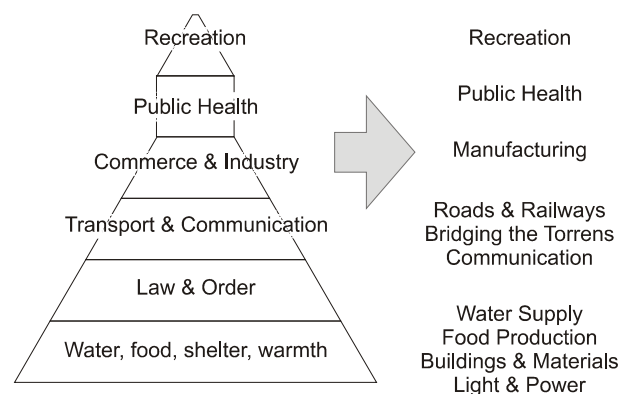


Figure 3. Colonists' Hierarchy of Needs

Once these needs were met, they could turn their attention to developing more complex aspects of infrastructure such as transport and communication.

4. WATER SUPPLY

The Torrens was the principal source of Adelaide's drinking water; however, it also became the bathroom, sewer, swimming pool, and rubbish dump.

Town Clerk Thomas Worsnop said³:

... few cities in the world were worse supplied than Adelaide. The inhabitants were compelled to depend upon water-carts, the drivers of which dipped the water out of the river and brought it to the houses ...

4.1 Water Carting

The price charged by the water carters depended on the distance from the river so that the City developed in the streets nearest the southern banks and not the centre, as Colonel Light had envisaged⁴. The water carters had to enter the river to fill their barrels. This meant that, not only were they polluting the water, but their carts were damaging the banks. In 1852, two firms installed pumps to raise water into holding tanks from which the carters could fill their barrels.

4.2 Adelaide's reticulated supply

In 1855 the Surveyor-General presented a report which recommended a storage option upstream on the Torrens at Thorndon Park⁵. The scheme had to be able to supply 800,000 gallons of water a day. A weir ten feet high would be built across the Torrens and a 20-inch pipe would conduct water to an off-stream reservoir. From here an 18-inch main would bring water to the City⁶. The weir was completed in June 1858; however, it was found to leak and an entire new weir had to be built. Water was first supplied on 28 December 1860⁷.

4.3 Extending supply

Additional storage reservoirs were commissioned: the first of these was at Hope Valley which took water from the same weir as Thorndon Park. Work on the new reservoir and aqueduct was completed in 1872 and water from Hope Valley was first supplied on 6 November that year⁸.

As the suburbs grew and water supply was extended, holding or service reservoirs were constructed in the Adelaide parklands. A reservoir near the intersection of Barton Terrace and O'Connell Street was built in 1878 and is still part of the water supply system.

The Glenelg service reservoir, near the intersection of East and South Terraces, was built in 1881. The drawings show an earth-covered mass concrete roof supported by curved corrugated iron sheets carried by iron girders resting on 58 cast-iron columns.

In 1928 the reservoir was taken out of service and in 1982 it was filled in although the size and shape of the original structure can still be seen. Sections of the original wrought iron fence still stand around the adjacent croquet club. Nearby is cast iron bench mark #10 (see Section 4.5).

4.4 The Valve House

The Valve House, built in 1857, contained the valves which controlled the supply of water. In 1974 the Engineering & Water Supply Department (E&WS) decided to transfer its operations elsewhere. The Valve House was relocated and rebuilt using the original materials. This was completed on 6 December 1982⁹ and the structure is now the only reminder of the workshops and works depot which once covered 3½ acres.

4.5 The cast-iron benchmarks

More than 30 cast iron bench marks were placed at key locations in and around Adelaide in 1879. The castings are about 1.2 metres high with a cast bronze plate showing the corresponding level. Many were removed when roads were widened but four remain within the boundaries of the City.

5. FOOD PRODUCTION

The basic diet of the early settlers was bread and water. The Torrens provided the water and in time the fertile soils of the Adelaide plains provided grain. This led to the establishment of two important industries in the City – flour milling and brewing. Many manufacturers proudly advertised their use of steam-powered equipment and were among the first to introduce gas (from the 1860s) and then electricity (from the early 1880s).

5.1 Flour Milling

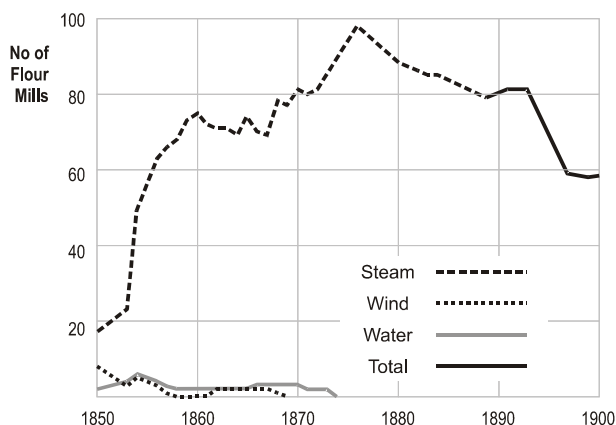


Figure 4. South Australian Flour Mills, 1850-1900

The growth in the wheat crop required a corresponding increase in the number of mills needed to grind it into flour (see Figure 4, based on Table 1 in Harrison¹⁰, derived from *Annual Returns of Flour Mills*).

Nine of these mills operated within or just outside the City. Most were built from the mid-1840s to the mid-1850s and some operated until the mid-1870s (Table 5.1).

Table 5.1: Adelaide City Flour Mills

Mill	Location	TA*	Years
Dr Kent's	Kent Town	--	1841 - 1845
→Albion	Grenfell St	107	1846 - 1866
City/Malin's	West Tce	464	1842 - 1851
Company's	Hackney	--	1842 - 1875
West Tce	Waymouth St	186	1842 - 1876
Cain's	Currie St	139-140	1843 -1849
Crown	Wright St	454	1852 - 1876
Clark's	Halifax St	564	1854 - 1859
Light Square	Waymouth St	195	1854 - 1876
Imperial	Hurtle Square	494	1856 - 1881

*Town Acre

The Albion Mill

Dr Benjamin Kent set up a mill just east of the City in 1840¹¹ and in 1845 moved it to a new building in Grenfell Street¹². In 1857 Kent sold the mill to George Sismey who gave it the name "Albion". The machinery was eventually moved to Gawler¹³.

The City (Malin's) Mill

The first flour mill built in the City was a windmill completed in August 1842¹⁴. The whole building and much of the mechanism had been made from local timber. It had ceased operating by 1852 when it was described as "dilapidated" in the rate assessment¹⁵.

The West Terrace Mill

In 1842 the architect George Kingston was commissioned to design a windmill. Built of brick, the six storey tower stood 50 feet tall. In 1845, the mill was struck by lightning which destroyed the sails and windshaft¹⁶. The proprietors then decided to convert the mill to steam power¹⁷. In April 1876, a fire broke out and destroyed the mill¹⁸.

The Company's Mill

The South Australian Company had imported mill machinery in 1838¹⁹ but didn't erect the mill until later²⁰. The mill commenced operations in 1842 and the following February exported the first flour from the Colony. The plaque on the site says the mill was demolished in 1875.

Cain's Mill

Thomas Cain operated a steam mill in Currie Street. *The Southern Australian* noted that "... it is very notorious in the city, for it may be truly said that ... its voice is *ever* heard."²¹ It was originally a saw mill powered by bullocks. The mill was later demolished to make way for the Elders Smith & Co building²².

The Crown Flour Mill

This mill was built at the eastern end of Wright Street about 1851/52. It is the only mill to have left its mark on the City by having a street (Mill Street) named after it. Later it became known as the Verco Mill.

The Light Square Mill

Built by George Wyatt (one of the sons of John Wyatt) in 1854, it was described as a roller mill and was powered by one of Wyatt's own steam engines. It was operated for a while by his brother Henry. John Marchant leased the mill and ran it from 1864 to 1870²³.

The Imperial Flour Mill

William Elliott's grand mill on the corner of Carrington Street and Hurtle Square was launched in fine style with a slap-up dinner at the Freemason's Tavern on Wednesday 14 May 1856²⁴. The building was "huge", the engines "powerful", and the store room "extensive". In 1860 the *Observer*²⁵ said that the Hurtle Square steam mill had not been in operation for some time. The building was later used as a tobacco factory.

Clark's Halifax Street Mill

By April 1851, William Henry Clark had completed a substantial brewery. Towards the end of 1853 he started building a large factory to manufacture ship biscuits²⁶ and also built a steam flour mill. The mill and brewery buildings remained untenanted for many years and fell into disrepair²⁷. The five-storey mill building, said to be one of the most imposing structures in the Colony, was subsequently adapted to house the City's rubbish incineration plant (see Section 12.2).

5.2 Brewing

A number of dedicated breweries were established within the City itself (see Table 5.2) and two are still standing.

Table 5.2: Adelaide City Breweries²⁸

Brewery	Location	TA	Years
Adelaide*	Wyatt St	--	1844 - 1902
Anchor	Morphett St	--	1855 - 1883
Dragon	South Tce	--	1871 - 1901
Enterprise	Waymouth St	--	1885
Grenfell St	Grenfell St	--	1839-1840
Clark's	Halifax St	564	1843 - 1863
Hindley St	Hindley St	--	1843 - 1847
Lion*	Jerningham St	987	1872 - 1914
Melbourne St	Melbourne St	--	1840 - c1858
Primrose	Union Lane	--	1844 - 1902
Torrens	River Torrens		1837 - 1843
Victoria	Holland St		1889 - 1919
West Adelaide	River Torrens		1838
West End	Hindley St		1859 - 1888

* Structures still standing

Adelaide (Pirie Street) Brewery

The original Pirie Street Brewery was built in the early 1840s. More cellarage, stores, a malting floor and malt kiln, and bottling rooms were added in the early 1870s. All these extensions were designed by Adelaide architect Daniel Garlick²⁹. The buildings still stand and have been converted to professional offices.

Clark's Brewery

William Henry Clark built and operated his Halifax Street Brewery from 1843 until 1857 when he began leasing it to various operators.

The Lion Brewery

In March 1871 tenders were called for the construction of a brewery at North Adelaide. It took a year to complete and began operating as the Lion Brewery. The brewing section was closed in 1914 but the company continued to produce soft drinks³⁰. In 1970, the brewery buildings were converted to apartments and the adjacent hotel is still trading.

The West End Brewery

The West End brewery was established by the hapless William Clark in 1859; the following year he went broke. The brewery was eventually taken over by the South Australian Brewing Company. All brewing operations were transferred to the Southwark Brewery and brewing ceased in the City in 1980³¹. The West End premises were demolished in 1983³².

6. BUILDINGS & MATERIALS

House building began in earnest when settlers took possession of their freehold land in March, 1837 ... able-bodied men and women set to work using simple materials close at hand ...³³

6.1 Early building materials

One of the first buildings to be erected in the Colony is still standing and still in use. It's one of a number of prefabricated Manning Houses brought to the Colony in 1840. No more than a dozen metres away, a companion Manning house, encased in brick soon after its assembly, is also still in use³⁴.

6.2 Ever-taller buildings

As new engineering materials became available, the sky was quite literally the limit for buildings but social and aesthetic concerns led to height restrictions being imposed³⁵. In 1911, the South Australian Government commenced a review which resulted in the *Building Act 1923*. The limits it imposed remained in force until a new Act was passed in 1961³⁶.

6.3 Reinforced concrete construction

Kither's building

In 1907 work began on one of the first reinforced concrete buildings in Australia. This five storey building had an impressive façade and balcony; however, these were removed in 1960 and all the significant structural features of the building have been hidden. The structural design was by John (later Sir John) Monash; however, it was not all built with concrete – some steel was used³⁷.

The Verco building

In August 1911, plans were prepared for Adelaide's tallest building which was built in two stages with the taller back (southern) section being built first³⁸. The structure was designed by Monash's South Australian

Reinforced Concrete Co Ltd who noted the "lofty nature of the structure"³⁹.

The T&G building

The T&G building was opened 23 November 1925. Its composite steel and reinforced concrete frame enabled it to reach the City's height limit of 132 feet; it was also the first to boast a full system of ventilation and electric lighting.

6.4 Steel-framed construction

The MLC building

After World War II another insurance/assurance company built Australia's first glass curtain wall building. The newspapers called it the "Light House" but it's now referred to as Beacon House for the distinctive MLC weather beacon which was removed in 1979.

6.5 Vertical transportation

Several hydraulic lifts powered by the City water supply were installed in City warehouses and in the Bank of South Australia building (now Edmund Wright House)⁴⁰. The first electric lift was installed in "Electra House" (see Section 10.4) in 1905 and was supplied by the Otis Elevator Company⁴¹.

6.6 Preservation of buildings

The former Bank of South Australia building had many notable features and was saved from demolition in 1971 when the State Government bought the property⁴².

The Marine & Harbours Board building was opened in 1884. When the land was needed for the construction of a building for the State Government Insurance Commission, lateral thinking resulted in a lateral solution to save the façade from demolition. On 8 December 1979, the 1000 tonne structure was moved 34 metres north on steel rails using hydraulic rams⁴³.

7. LIGHT & POWER

7.1 Mechanical power

The first "home-made" steam engine was the *Cyclops* completed by George Wyatt at his father's Grenfell Street foundry on 8 September 1843⁴⁴.

7.2 Town and Natural Gas

One of the earliest reported gas lighting installations was at the Freemason's Tavern: it was "brilliantly illuminated" on the evening of Monday 7 September 1846 with gas produced on the premises by a plant made by John Wyatt's foundry⁴⁵.

The South Australian Gas Company (SAGasCo) was not formed until 1861⁴⁶. They built a gasworks at Brompton and regular supply to consumers began on 22 June 1863. Supply was extended to North Adelaide on 23 May 1864 and to nearby suburbs soon afterwards.

Demand was such that a second gasworks was completed at Port Adelaide in November 1866⁴⁷.

7.3 Street Lighting

Street lighting was a haphazard affair until the gasworks opened. Even then it was several years before the Council signed a contract with the Gas Company in June 1867⁴⁸. However, of the 285 lamps erected, the mains had only been laid to 115 of them; the others were lit with kerosene⁴⁹.

The Council installed their first electric street lamp in 1895; the arc lamp at the intersection of Hindley and Rundle Streets was supplied from the nearby Theatre Royal⁵⁰. A few years later the Council signed a contract with the South Australian Electric Light and Motive Power Company (SAELMP) and 31 arc lamps were lit on the evening of 4 January 1900⁵¹. Gas lights continued to be installed until 1913 but had all been replaced with electric lamps by 1921.

7.4 Electricity Supply

SAELMP built a power station near East Terrace. The station didn't officially open until 19 November 1901 so the Company supplied street lighting and other customers from a temporary power plant⁵². On 31 August 1904 the undertaking was sold to the Adelaide Electric Supply Company (AESCo) which, over the coming years, became South Australia's main electricity supplier⁵³.

In 1902 AESCo installed motor generators to convert direct current (DC) to alternating current (AC) which enabled supply to be extended further⁵⁴. Later, when AESCo built a new AC power station near Port Adelaide, a converter station was built to maintain DC supply in the City; this opened on 30 August 1925. A few years later, almost all the DC loads in the City had been converted to AC but a skeleton DC supply was maintained from a rectifier station until 3 January 1967⁵⁵. The MTT (see Section 8.3) also built its own converter station in 1907 to supply DC for the tram network. An Historic Engineering Marker was placed at the power and converter stations on 6 April 1995

8. ROADS & RAILWAYS

8.1 Road making

King William Street was the first properly-made road in the City, prepared with sand from the Torrens and limestone gravel from the parklands quarries in 1842. In 1895, possibly for the first time in Australia, some of the side streets were dressed with tar, a by-product of gas production⁵⁶. Better results were obtained using distilled tar and the Council installed its own plant at the destructor station in 1911 (see Section 12.2).

8.2 Railways

In 1856, the first State-owned steam railway in the British Empire began operating between Adelaide and

Port Adelaide⁵⁷. The consulting engineer was Isambard Kingdom Brunel and the original rails were therefore the same bridge or hollow type used on his Great Western Railway. Unfortunately they proved unsuitable in South Australia's hot dry climate and, by 1868, had all been replaced⁵⁸. Three locomotives were imported from England and the line opened for general traffic on 21 April⁵⁹. The line was duplicated in 1881⁶⁰.

The first Adelaide Railway Station opened in 1856. It was extended several times and then replaced with today's building which opened on 28 June 1928.

8.3 Tramways

Adelaide was the first Australian city to have a complete system of tram cars⁶¹. An Act authorising the establishment of horse tramways was passed on 22 December 1876 and most suburbs soon had a service⁶². The Municipal Tramways Trust (MTT) was formed in 1907 to buy out the seven suburban horse tramways and "electrify" the lines. The first section opened on 9 March 1909; the conversion was completed by 1914. The first tramcar bodies were built by local firm Duncan & Fraser⁶³.

The MTT built three converter stations to supply DC to the tram network including one on East Terrace (see Section 7.4). A large workshop and depot (now demolished) and an administrative building were built near the Botanic Gardens; the latter still stands.

In the early 1950s diesel buses were seen as a better transport option. Post-war petrol rationing had ended and bus routes could be extended without massive capital expenditure on tracks and overhead power lines. The power house closed on 29 June 1956 and the last street tram ran from Cheltenham to the City on 22 November 1958⁶⁴. Only the tram to Glenelg (which has its own separate right-of-way) was left⁶⁵.

The Adelaide to Glenelg tram service commenced on 14 December 1929, replacing the train service which began on 4 August 1873⁶⁶. The line was extended through the city to North Terrace in 2007 and is now operated with "Flexity Classic" trams made in Germany.

8.4 Buses

The first City service was begun by a private operator with one motor bus on 17 December 1914. On 25 March 1925 the MTT began its own bus service but with fuel engines rather than electric traction. On 7 November 1928 the MTT was given the exclusive right to carry passengers by "motor omnibus" in the metropolitan area⁶⁷.

Unique to Adelaide is the O-bahn bus service, the world's longest and fastest guided busway which runs north-east of the City. The concept was developed by Daimler-Benz and introduced in 1986. Special buses equipped with guide wheels connected directly to the steering system leave the streets at North Adelaide and

travel at speeds of up to 100 km/h on the elevated 12 km long concrete track.

9. BRIDGING THE TORRENS

Successfully bridging the river was to prove a significant engineering challenge which would take nearly 14 years to master (from 1839 to 1853).

9.1 *The First Bridges*

In May 1839 work commenced on a “strong and temporary” bridge under the supervision of Alfred Hardy, the Town Surveyor. Flood damage was repaired in 1843 but the following year it was carried away. The location is marked by a cairn on the southern bank.

9.2 *The City/Adelaide Bridge*

A timber-decked bridge supported by iron bow-string girders carried on masonry abutments was opened in October 1856 and named the City Bridge. But within twenty years its roadway was proving inadequate for traffic.

In 1874 the City Council decided that a new City Bridge was needed. It was renamed the Adelaide Bridge when it opened on 25 April 1877. In August 1920 the City Engineer prepared plans for a new bridge but the work was deferred for several years. Finally, the new concrete arch bridge was officially opened on 5 March 1931⁶⁸.

9.3 *The Frome Bridge and University Footbridge*

The Frome bridge opened on 18 August 1842. It was damaged by floods and finally destroyed in 1855. A ford and then a footbridge replaced it until the Albert Bridge opened⁶⁹.

The idea of a footbridge connecting the University of Adelaide with its playing fields north of the river was put forward by a civil engineering undergraduate in 1928. The bridge was designed by the South Australian Railways and opened on 9 August 1937. It was the first welded steel bridge built in South Australia and consists of two balanced cantilever sections joined by lateral shear locks at the apex of the arch⁷⁰.

9.4 *The Hackney Bridges*

The river crossing at Hackney was an important one because it gave wheat growers on the Adelaide Plains direct access to the SA Company’s flour mill (see Section 5.1).

The first bridge was a simple timber structure built about 1845 which managed to survive six years of floods until 24 September 1851. Traffic then went back to using the ford or had to detour downstream to the Frome Bridge. A contract was let for a new bridge on 17 October 1853 and it opened on 8 May 1855. The deck was carried by timber trussed girders fixed by iron-plated joints. However, the timber structure required constant repairs and finally succumbed to termite attack. The bridge was declared unsafe and closed towards the

end of 1883⁷¹. (The banks were also damaged by scouring to the extent that the mill itself closed and had to be demolished in 1875.)

A new bridge was designed with seven wrought iron arch truss ribs, the first bridge in South Australia to use this form. The abutments were made of concrete and faced with masonry; it may have been one of the first projects to use locally-produced Portland cement (a plant had opened at Brighton on 12 December 1882⁷²). The bridge was opened on 5 December 1885 and still carries south-bound traffic today. The timber deck was replaced with reinforced concrete in 1937-38 and a new bridge carrying north-bound traffic was completed on the downstream side in 1968⁷³.

9.5 *The Victoria and Morphett Street Bridges*

The Victoria Bridge was opened on 21 June 1871. However, to use it the citizens first had to cross the railway line. A level crossing was provided in 1860 but public protest led to the construction of the Overway Bridge in 1868. Twelve years later it was demolished and the level crossing was reinstated. In 1884, a lattice girder bridge was built across the railyards.

In 1964, the City Council decided to replace both bridges and realign the Morphett Street exit to North Adelaide. A contract was awarded in May 1966 and the present twin bridges (crossing the railyards and the river) were completed in May 1969. They are prestressed concrete trapezoidal box girder structures⁷⁴.

9.6 *The Albert Bridge*

When the old City Bridge was replaced, the City Council stored the old bow string structure with a view to re-erecting it. However, it proved cheaper to build a new one and a design competition was held. The winning design by John Grainger and Henry Worsley had wrought-iron girders resting on cast-iron piers filled with concrete; it remains an attractive structure across the river, despite the awkward bends in the approach road. Iron work was ordered from England but it was fabricated and erected under the local supervision of the City Surveyor James Langdon. The bridge was opened on 7 May 1879⁷⁵. The timber deck was replaced with concrete in 1933-34 and that deck was reconstructed in 1982. A refurbishment in 2001 added traffic safety barriers and won Connell Wagner an Engineering Excellence Award.

10. COMMUNICATION

10.1 *Telegraphy*

When the Government decided it needed to have a telegraph line linking Adelaide with its port, Charles Todd was chosen for the task. He arrived in Adelaide on 5 November 1855 with his assistant Edward Cracknell and built a double circuit line which opened for general traffic on 18 February 1856⁷⁶.

10.2 The Intercolonial Telegraph

Todd's next step was to establish communication with Victoria. A 320 mile line connecting Mount Gambier with Portland in western Victoria was opened on Wednesday 21 July 1858⁷⁷. Three months later, a line connected Sydney with Albury on the NSW-Victorian border and from 9 October 1859 Adelaide was in direct communication with both Melbourne and Sydney. A direct link to Sydney was not built until May 1867⁷⁸

10.3 The Overland Telegraph

As telegraph lines crept steadily eastwards through the sub-continent and Asia, communication with England and Europe became a growing possibility and the South Australian Government made a bold decision to build a line to connect with the overseas cable. Charles Todd was given the formidable challenge of building the 1200 mile line in just 18 months. The first pole was planted at Port Darwin on 15 September 1870⁷⁹. The overseas cable was ready for service on 20 November 1871 – unfortunately the Overland Telegraph line wasn't. It was finally joined on 22 August 1872. In the meantime, the undersea cable had failed and wasn't back in service until 21 October. The first message from overseas was received at the Adelaide GPO on 22 October⁸⁰. An Historic Engineering Marker was placed at the GPO on 22 October 1999.

10.4 Electra House

The Eastern Extension Australasian and China Telegraph Company controlled the overseas cable. In 1921 the company acquired a building in King William Street which they named Electra House in 1940⁸¹. As radio transmission took the place of cable, the need for the station declined and it closed on 15 January 1949⁸².

10.5 Telephones

The first South Australian experiments in telephony were carried out by Adelaide brassfounder A W Dobbie⁸³. The Postmaster General's Department (PMG) in Adelaide began trials of telephone equipment in January 1878. These were the first official telephone experiments to be conducted in Australia⁸⁴.

A number of private lines, most of them connecting the City with its port, were erected in 1882 but the telephone exchange in the north-west corner of the telegraph room in the GPO didn't open until 14 May 1883; there were 48 subscribers⁸⁵.

A three-storey building to house the central telephone exchange was erected in 1908⁸⁶. The exchange closed on 13 May 1955.

10.6 Wireless

On 21 September 1897 Professor (later Sir William) Bragg gave the first public demonstration in Australia of wireless telegraphy⁸⁷. The State Government asked Charles Todd to investigate and on 10 May 1899 Bragg and Todd were able to establish communication over a

distance of about 200 yards. Although their experiments were well ahead of work being done in the other States, the cost was still too great for a system to be installed and the project was abandoned in February 1900⁸⁸.

About 1922, people began exploring the possibilities of broadcasting as a form of entertainment⁸⁹. Several radio stations were established and Adelaide's tall buildings were popular choices for studios; many had transmissions masts on their rooftops.

11. MANUFACTURING

In the 19th century, Adelaide was literally a hive of industry with all manner of manufacturing taking place within its square mile. Fortunately for today's citizens, it was all shifted to more appropriate locations long ago and the streets give no clue to the foundries and factories and sawmills that once gave employment to thousands.

11.1 Foundries

Significant in the early engineering history of Adelaide are the pioneer foundrymen John Wyatt and William Pybus. John Wyatt arrived in the Colony on 22 April 1837 and, by 1841, had established an engineering business. A few years later he built a foundry in Grenfell Street called the Adelaide Foundry. In 1847 he moved the foundry and workshops to large premises on North Terrace at the corner of Victoria Street. His sons George and Joseph Henry took over the business in 1847. Following the death of the brothers, the foundry was sold to A Jones & Sons in 1878⁹⁰.

Table 11.1: Adelaide City Foundries⁹¹

Foundry	Location	TA	Years
Wyatt/Adelaide	Grenfell St	--	1843 - 1847
Wyatt/Adelaide	North Tce	11	1847 - 1878*
Pybus/Victoria	Hindley St	76/111	1842 - 1848
Pybus/Victoria	Hindley St	60	1848 - 1915
Pappin & Jones	Blyth St	13/50	1855 - 1867
A Jones & Sons	Blyth St	13/50	1867 - 1878
A Jones & Sons	Union Lane	11	1878 - 1912
A W Dobbie	Gawler Pl	81	1862 - 1914
A W Dobbie	Pirie St	--	1914 - 1931
Hooker	Hindley St	--	1875 - 1883
Strapps	Currie St	131	1863 - 1944
Forwood Down	Hindley St	69	1873 - 1955
Union	Blyth St	--	1882 - 1907
Union	Morphett St	54	1907 - 1915
Sun	North Tce	3	1886 - 1896
Stewart & Harley	Hindley St	68	1896 - 1909
Harley/Sun	Hindley St	68	1909 - 1926
Cornwall	Hindley St	--	1898 - 1913

* Then sold to Jones & Sons

William Pybus established a foundry around 1842 and was possibly the first in Adelaide to do so⁹². He was also a partner in establishing Adelaide's water supply (see Section 4.1). Many of the other major foundries were established in the City itself and are listed in Table 11.1.

Many of these foundries have left their mark on Adelaide, their names being found on various gates, pillars, etc. The Sun Foundry, in particular, produced a wide range of products including much of Adelaide's distinctive cast iron lace work. Alan Harley joined founder Colin Stewart in 1887 and bought out the partnership in 1909⁹³. Fulton & Co, founded by George Fulton and Robert Lungley in 1879, had an office in the City but their foundry was in the suburb of Goodwood⁹⁴.

11.2 Automobile Manufacture

Until quite recently, Adelaide was home to not one but two major automobile manufacturers - General Motors- Holden and Mitsubishi Motors Australia; both had their origins in coach building and saddlery. J A Holden & Co was established in 1856 and built their first motor bodies in 1914. Four years later they formed a separate division, Holden Motor Body Builders, and built a large factory in King William Street. The General Motors Corporation bought the business in 1931 and merged it with General Motors Australia to form General Motors Holden⁹⁵. Duncan & Fraser had a similar story, building custom bodies for Ford (as well as tram bodies – see Section 8.3); in 1930 they were taken over by T J Richards, another local business, which had been building Chrysler bodies since 1928. Richards, in turn, was taken over by Chrysler Australia which was then purchased by Mitsubishi Motors in 1980.

Tom O'Grady, foreman of the Lewis Cycle Works, built a small gasoline engine and fitted it to one of their pacing triplets. It was seen on the streets of Adelaide early in 1899⁹⁶. The following year they began to build a motor car in their workshops off Gawler Place⁹⁷ and went on to produce at least eight more⁹⁸. Other vehicles were made in local workshops, most of them cycle manufacturers but at least two were made by James Henry Southcott. Southcott was a precision machinist who founded his Gilles Street business in 1886.

12. PUBLIC HEALTH

12.1 Sewers and Drainage

In the 1870s, Adelaide's death rate was nearly double that of rural areas⁹⁹. An Act was passed in 1879 and main sewers were constructed. A Sewage Farm was established north of the City and, from 7 January 1881, Adelaide became the first Australian capital city to provide a separate water-borne system¹⁰⁰. The Farm continued to operate until 1964 when the first stage of a new treatment plant opened at Bolivar.

12.2 Rubbish Collection and Disposal

At first rubbish was dumped in the Parklands in pits left by the removal of limestone for building. A destructor station or incinerator was discussed as early as 1894. Heenan & Froude Ltd of Manchester installed a three cell, two unit refuse destructor; rubbish was first processed on 20 June in what was effectively a recycling station – even the soot from the chimney was

collected and used as top-dressing on the parklands gardens! The station closed in 1954 and everything but the chimney and a few small outbuildings was demolished in 1997.

13. RECREATION

With all the basic needs finally catered for and local industries up and running, the citizens could finally turn their minds to enjoying themselves and the centrepiece of their recreation was to be the River Torrens. It is fitting, then that this story of Adelaide's engineering heritage should start and finish with its river.

13.1 The Botanic Gardens

Adelaide's Botanic Gardens were established on their present site in 1854. Director Dr Richard Shomburgk wanted to start a collection of palms and ordered a special glass house. Designed by Gustav Runge in Bremen, Germany, the Glass House was transported to South Australia in kit form and then assembled on site. It opened in 1877. Its hanging glass walls are similar to those used in modern city buildings. The design was very advanced for its time and is the only structure of its kind in the world today.

It was closed in 1986 because corrosion of the iron glazing bars made it unsafe for public use. A full restoration commenced in 1992 and it now only displays plants which require warm and dry conditions to preserve its wrought iron structure.

13.2 Torrens Lake and Elder Park

The first attempt to create an ornamental lake was in October 1867 when the Sheriff of the Adelaide Goal used prison labour to build a wooden dam. It was washed away almost immediately.

Construction of a simple concrete weir began in November 1880; this was one of the first uses of concrete in a civil engineering project in Australia. Mayor Edwin Smith closed the sluice gates for the first time on 1 July 1881. In 1889, the first serious flood overwhelmed the new weir and jammed its gates with debris. In 1917, the City Engineer, prepared plans to replace the centre section of the weir with two flood gates and the rebuilt weir was reopened in May 1929.

14. THE BOOKLET PROJECT

Sadly, for technophiles, all this activity has left little sign of its presence in today's City. What was finally chosen for the guide booklet was based on three requirements:

1. Was there something left to see?
2. Did it help tell the story of the City?
3. Was it unusual or amusing?

As the research progressed, we were able to increase the original list of 17 items to more than 70. However, they literally stretched from one end of the city to the other and this is where the Adelaide City Council's Connector

Bus makes a happy contribution – it circulates through the City and effectively connects all the places that people might want to visit.

15. ACKNOWLEDGMENTS

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The units originally published are used throughout. There are plenty of sources available to convert British or Imperial units to the CGS system.

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