Adam Hunter

born 23rd August **1869**, Crossford, near Dunfermline, Fife, UK
died 1st November **1933**, The Grove, 34 Buchanan Drive, Rutherglen, Lanarkshire, UK
era **Victorian**

Written by **Eleanor Knowles**, edited by **Jane Joyce**
in association with **Professor Roland Paxton**

Scotsman Adam Hunter spent his career working on civil and structural engineering projects round the world for major British contractor Sir William Arrol & Co Ltd. He was a pioneer in the fabrication and erection of large steel structures, and an authority on their design. Though not so well known today, he was acknowledged among his peers as one of the great structural steelwork engineers.

Hunter was born in the middle of the Victorian era — 100 years or so after steam pioneer **Richard Trevithick**. In that time the world changed profoundly, perhaps more than in any previous 100-year period. Railways and motor vehicles became commonplace and communication became easier and faster — from letters to telegrams to telephones.

Engineering had changed too and steel was becoming more commonly used for construction. As an apprentice, Hunter worked on the iconic **Forth Rail Bridge**, the first large-scale use of steel in bridges. As Chief Engineer with Arrol, he is associated with the design and construction of many significant projects in Britain — especially in Scotland — and around the world, including London's **Southwark Bridge**. His textbook, *Bridge and Structural Engineers' Handbook* (first published 1920) was the definitive work on the subject for some 60 years.

Hunter followed Sir William Arrol's own lead in developing prefabrication techniques, enabling considerable simplification of the construction of complicated structures. The major part of his work concerned **road and rail bridges** but other significant projects include **industrial process buildings** and **giant cantilever cranes**. He also worked on lock and dock gates, viaducts and power stations.

After his death, his contemporary Professor George Moncur remembered him in glowing terms, saying he had *"a generous and genial disposition"* and *"was very highly esteemed by all who came in touch with him, not only for his great professional ability, but for his sterling worth and amiable personality"*.

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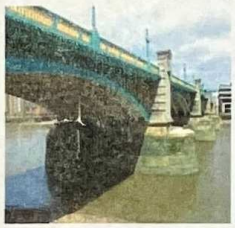

Southwark Bridge (1921)

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Early years

Adam Hunter was born in 1869 — the same year that the British supermarket chain Sainsbury's opened its first store in Drury Lane in London, and the great Victorian engineering project in Egypt, the Suez Canal, opened to shipping.

He shared his name with his grandfather (1814-94) and his father (1845-1918). Engineering also seems to have been a common thread in the family — his grandfather had been an engineer at Elgin Colliery, Dunfermline in Fife, Scotland, and his father was a civil engineer.

His grandfather had married Helen Chalmers (1813-89), and they had seven children — William (born 1835), Jean (1837-77), John (born 1840), Janet (1841-81), Adam (Hunter's father), Thomas (1849-59) and George Muir (1854-58).

Hunter's father had begun his working life as an apprentice pattern maker at Provost John Whitelaw's (born 1809) foundry in Dunfermline. On 22nd October 1866, he married Hunter's mother, Jane Campbell Johnston (1848-1927) at Anderston in Glasgow. They had moved to Crossford near Dunfermline by the time Hunter was born on 23rd August 1869. He was the first of the couple's eight children.

In 1870 Adam Hunter senior took a post as an engine pattern maker at McNab's engineering works at Greenock in Renfrewshire, by which time the family was living at 33 Ingleston Road in the town.

Five more children were born into the Hunter household at Greenock — Peter (1871-1946), Sarah (born 1876), John (1878), William (1880) and Johnston (1882). They later moved to Cruickness at Inverkeithing in Fife, where Hunter senior was working as a civil engineer. Two more sons completed the family — Campbell (born 1887) and Thomas (1890).

Adam Hunter junior finished his education in Greenock and embarked on an engineering career at the age of 16. In 1886, he started an apprenticeship that would see him working on the construction of the **Forth Rail Bridge**, where his father was in charge of the workshops. This groundbreaking project is the first large-scale use of steel in a bridge.

See also our feature on the building of the **Forth Rail Bridge**

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Tower Bridge
(engineers: Sir John Wolfe Barry and Henry Marc Brunel)
Hunter transferred to Arrol's London office in 1889. From 1890-5 he worked under James Tuit on the steelwork for Tower Bridge.

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William Arrol & Co and new horizons

After leaving school, Adam Hunter's first taste of engineering was as an apprentice pupil at Tancred, Arrol & Co, where he was supervised by engineer James Edward Tuit (1860-1906).

Tancred, Arrol & Co was a partnership between Sir Thomas Selby Tancred (1840–1910), William Arrol (1839-1913), Joseph Phillips (1828-1905) and Irishman Travers H. Falkiner (1829-97). At the time, they were contractors for three major Scottish railway projects — the **Caledonian Railway Viaduct** over the River Clyde (completed 1878), the replacement **Tay Rail Bridge** and the **Forth Rail Bridge**.

The contractor's job is to construct projects specified by consulting engineers and architects, turning designs into reality. Towards the end of the nineteenth century, with the availability of new materials and the increasing ability and ambition to tackle larger, more complex structures, contracting firms took on the significant challenges such projects entailed. They employed specialised engineers and co-ordinated the many trades involved. Construction was becoming more industrialised.

William Arrol had founded the Dalmarnock Iron Works in Glasgow's Dunn Street in 1871, and he soon became a noted steelwork engineer. He had his own company too — William Arrol & Co. This was amended to Sir William Arrol & Co when the Forth Rail Bridge was finished and Arrol was knighted (see the feature on the building of the **Forth Rail Bridge**).

From 1886 to 1889 Hunter was an apprentice at the Forth Rail Bridge works at South Queensferry in Edinburgh. His father had been in charge of the workshops since 1885, and the *Glasgow Herald* would later report that "by his [Hunter senior's] methods of construction the time for building the bridge was reduced by fully two years and on its completion in 1890 he was appointed resident engineer [for the operational structure]".

Young Hunter gained invaluable experience during the erection of the bridge and documented the work he was engaged on in a series of drawings. These include drawings of annealing furnaces; hydraulic bending and other fabricating machinery; a winding engine and gear for a jetty; and hydraulic riveters — the latter invented by Arrol. Joseph Phillips's son Philip J. Phillips (born 1857) photographed the bridge's ongoing construction. These images are now an historical resource.

In December 1889, the 20 year-old Hunter was transferred to Arrol's London office at 32 Victoria Street, Westminster. He was promoted to Assistant Civil Engineer and worked on the design and erection of steel bridges and other structures, again with James Tuit, who was by then Chief Design Engineer. Hunter was paid two guineas (£2.10) a week.

By 1890 Tuit was one of the company's directors. Hunter worked with him in 1890-5 on various projects, including the steelwork for **Tower Bridge** (engineers: Sir John Wolfe Barry and Henry Marc Brunel), various swing bridges over London docks and the rebuilding of **Shoreham Viaduct** (original 1845). Tower Bridge is probably the most famous structure associated with William Arrol & Co, as emblematic of London as the Forth Rail Bridge is of Scotland.

Hunter must have been interested in more than just the practical application of his engineering knowledge, for in 1890 he embarked on a course of evening classes at the City of London College, completing his studies in 1893. The Church of England had founded this institution in 1848 as "Metropolitan Evening Classes for Young Men". It became City of London College in 1861 and merged with other establishments to became the City Polytechnic in 1891. After several more name changes it's now London Metropolitan University.

While working and studying in London, Hunter lodged in the Westminster area. In mid 1890 he was in Bessborough Gardens and by April 1891 he was at 46 Vincent Square. He was evidently a keen diarist and his 1890 diary survives, showing that his income that year was £128 (£10,400 in 2009 using the retail price index) and his expenditure was £101 — about half of which went on board and lodgings.

He also spent about £5 on technical books and papers, beginning a collection that was to form an impressive personal library. In 1890 he took the periodicals *The Engineer*, *Engineering*, and *Mechanical World*, as well as the *Daily News*, which had been founded in 1846 by Charles Dickens. He also bought books on ironwork and bridges, including William John Macquorn Rankine's *Civil Engineering* (first published 1862) and works by Thomas Minchin Goodeve on mechanics and mechanisms.

Perhaps one of Hunter's most useful books at that time was Wilhelm Westhofen's definitive *The Forth Bridge* (first published 1890). Westhofen was born in Germany and a naturalised British subject who had worked as an assistant engineer on the bridge. He moved to South Africa with his wife and children in 1892.

Despite filling his days with work and his evenings with education, Hunter's diary shows he kept in contact with his family, attended concerts and lectures, was interested in music and fine arts, visited 25 of London's visitor attractions, smoked a pipe and fell into the River Thames. Fortunately this last escapade was not as hazardous to his health as it would have been before Sir Joseph William Bazalgette's (1819-91) work in the 1860s and 70s on diverting sewage into the purpose-built inner London sewer network that is still in use today.

Hunter's brother Peter Johnston Hunter also appears to have inherited the family engineering bias. The 1891 census shows that the 19 year-old Peter was working as a steam engine fitter and lodging at 7 Glebe Park Street in Kirkcaldy, Fife.

Adam Hunter was doing well at Arrol. In 1895, he would be promoted and the next decade would see him working on significant British projects — and ones that would take him further afield.

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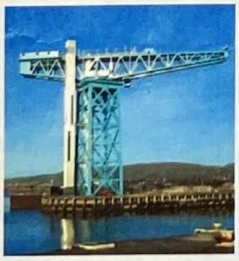
Dalginross Bridge



Titan crane, Clydebank

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Cranes, bridges and workshops

In 1895, Adam Hunter was 25 years old and promoted to Chief Assistant Engineer at the London offices of Sir William Arrol & Co. Still working with James Tuit, his mentor from day one, and tackling similar projects to those of earlier years, he steadily gained more responsibility.

In London he met Lottie Ruth Patrick (1872-1951) from Harleston in Norfolk, whom he married in July 1900 in Marylebone. The couple lived at 49 New Clive Road in Lambeth, where their daughter Ruth Whiting Hunter (1901-92) was born.

Tuit suffered from ill health and, possibly because of this, Hunter was Arrol's Acting Chief Engineer from March to May 1904, throughout 1905, and up until Tuit's death on 20th February 1906. Tuit was only 46 when he died.

Meanwhile, Hunter was responsible for the first constrained steel cantilever bridge in Britain — **Dalginross Bridge** in Scotland. A blueprint of the bridge dated 26th February 1904 is signed J.E. Tuit, Director, drawn by A.G. Harrison and checked by A. Hunter. He worked also on the **Swale Rolling Lift Bridge** on the Isle of Sheppey in Kent. This was replaced in 1960 by the **Kingsferry Vertical Lift Bridge**, for which Arrol engineered the machinery.

Other construction work in the UK and Ireland included an **electric derrick crane** with a 152 tonne lifting capacity at Clydebank (now demolished), the **New Clyde Bridge** and **Glasgow Central Station Bridge** for the Caledonian Railway, **Jubilee (Walney) Bridge** at Barrow-in-Furness, **Rosslare Harbour Viaduct** and **Barras Swing Bridge** in Waterford.

Work started to take him overseas too, beginning in 1904 with bridges for the **Suakin-Berber Railway** between Suakin on the Red Sea and Berber in eastern Sudan. He moved north to Egypt for the design and construction of large bridges across the River Nile in Cairo — one of the **Nile Bridges** was 535m long. He acted as on-site technical adviser from November 1905 to March 1906.

After Tuit died Hunter became Arrol's Chief Engineer. At about the same time, the London office moved to Glasgow, with Hunter directing operations from the new civil engineering department at the company's headquarters at Dalmarnock Iron Works in Dunn Street. The fledgling Hunter family moved to a semi-detached house at 8 Viewpark Drive, Rutherglen, south east of Glasgow in Lanarkshire. This was to be his home town for the rest of his life.

In his new role he supervised the construction of all Arrol's major works. During 1906-9 he worked on projects in Ireland, the UK and north Africa. These included the **River Suir Bridge** and **Barrow Viaduct** in Waterford — Barrow was longest viaduct in Ireland at the time, and supported on foundations almost 36m below high water.

Scottish works began with a 152 tonne capacity hammerhead-type electric **Titan crane**, the precursor of a series of giant cantilever cranes. This one survives and is now open to visitors. It's located on the west side of the former John Brown & Co shipyard basin in Clydebank. The derrick crane was on the east side.

Forty-two giant cantilever cranes were erected in various locations around the world. Arrol constructed at least 14 of them (probably 21), including six of the eight built in Scotland. Fewer than 15 still exist anywhere.

Apart from a **shale conveyor plant** at Addiewell in West Lothian, where oil was extracted from shale spoil heaps, Hunter's other Scottish projects relate to railways — bridges over **Kingston Street**, **Nelson Street** and **Wallace Street** in Glasgow for the **Caledonian Railway**, plus **Waverley Station** and **North Bridge** in Edinburgh.

In England, Hunter worked on the widening of London's **Blackfriars Bridge**, the **Stockton Heath Swing Bridge** on the **Manchester Ship Canal** and another giant cantilever crane for North Eastern Marine Engineering Co at Wallsend, north Tyneside (now demolished). Elsewhere, there was the **Kings Dock Swing Bridge** in Swansea, and cranes and gantries for a new slipway at the Harland & Wolff shipyard in Belfast. In Egypt he was involved in the **Dowrle & Co works** in Port Said and the **Assiut Barrage Lift Bridge**, and in central Sudan with the **Jebel Aulia Barrage** lift bridge and lock gates.

Arrol — and therefore Hunter — also specialised in erecting buildings for heavy industrial processes. Up to 1910, the company built at least 40 of these, about two thirds of which were in Scotland and the remainder in England.

Hunter's varied experience led him to prepare a guide that would standardise Arrol's methodology in its specialisms. This was published in July 1909 as *General specifications, formulae and data, for cranes, bridges and workshop buildings embodying the practice of Sir William Arrol and Company, Ltd* in the journal *Engineering*. Hunter would later revise and extend it into an authoritative textbook —

Bridge and Structural Engineers' Handbook (1920).

In 1910 Hunter became a director of Arrol. He extended the company's expertise with giant cantilever cranes, erecting one of 203 tonne capacity at the Fairfield Shipbuilding & Engineering Co Ltd basin at Govan in Glasgow (demolished 2007), and 254 tonne capacity machines at Rosyth Dockyard in Fife (demolished 1992), at Portsmouth Naval Dockyard (demolished 1984) and at the Imperial Japanese Navy Dockyard in Sasebo, Japan.

Steelwork for overseas projects was usually fabricated at Dalmarnock Iron Works and shipped in sections. This was certainly true of the **Tapti River Bridge** at Bhusaval in Mahashtra, India, built for the Great Indian Peninsula Railway.

World War I broke out in July 1914. As a married man, Hunter was exempt from having to join the army. This rule would be abolished in 1916, and conscription for men aged 18-41 years (later 17-51 years) was introduced. Even so, he was an engineer working in industry, a reserved occupation.

Before and during the war, Hunter was responsible for significant works carried out by the Admiralty, the War Office and the Air Ministry. One of his Admiralty projects was the **Royal Navy Oil Terminal** at Lyness on the island of Hoy, Orkney, where Arrol built a steam-powered pumping station and four 12,190 tonne oil storage tanks. Another was the Harland & Wolff shipyard at Govan. In 1916, Hunter worked on tube furnaces for the Tsaritsyn Gun Works in south west Russia.

He also continued to work on bridges and cranes. Two more giant cantilever cranes were built — one of 203 tonne capacity for HM Dockyard at Woolwich Arsenal, London,and another of 152 tonne (the **King George V Crane**) at James Watt Dock in Greenock, Inverclyde.

There was the construction of bridges in Britain and abroad in 1916-8. The first was **Keadby Rolling Lift Bridge** (engineer: James Ball) in Lincolnshire, which has a Scherzer mechanism with the largest span of its type when built. This was followed by the reconstruction of **Downs Road Railway Bridge** in Hackney, London. Other bridges included the **Makhaleng Bridge** on the South Africa/Lesotho border and a bridge for Chemin de Fer de l'Est, the Eastern Railway of France.

The war ended in 1918, leaving widespread devastation in its wake. Hunter was consulted by the War Graves Commission on engineering matters and visited France several times. The post-war period brought a lot of work to engineering firms such as Arrol and the 1920s would see Hunter working harder than ever.

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Southwark Bridge
(engineer: Mott Hay & Anderson)

Wearmouth Bridge (1929)
(engineer: Mott Hay & Anderson)

At his peak — the 1920s

In 1919 Adam Hunter was 50 years old. World War I was over and the devastation it wrought to infrastructure was beginning to be repaired. Engineering firms were busy, and Sir William Arrol & Co, of which Hunter was a director, was no exception.

Of the 74 schemes that we know Hunter worked on between 1919-29, more than a third were outside the UK, although some of the fabrication was carried out in Britain. By far the largest share of these were bridges — 17 in the UK and 15 abroad.

Unfortunately, little is known of Hunter's home life during this period. However, his engineering skills were much in demand. One of the first projects for the decade was to provide lock gates, a swing bridge, a 5.3m wide bascule bridge and a floating caisson for **King George V Dock** in London. The swing bridge linked the dock with Royal Albert Dock. It was demolished when the area was redeveloped — London City Airport (1987) now occupies the site. Arrol's bascule bridge was replaced by a wider version in 1990.

Hunter reprised Arrol's giant cantilever crane design with a 152 tonne lifting capacity machine for the North British Diesel Engine Co at Scotstoun (Whiteinch) in Glasgow. The crane still exists, though it is not operational.

In 1921, the replacement for fellow Scotsman John Rennie's (senior, 1761-1821) cast iron **Old Southwark Bridge** across the Thames in London was completed. It was constructed by Arrol to designs by architect Sir Ernest George and engineer Basil Mott of Mott, Hay & Anderson. The new **Southwark Bridge**, the one we know today, features steel plate girder ribs.

Hunter is also associated with another of Rennie senior's bridges in London. In 1923, three piers of the original **Waterloo Bridge (1817)** were found to be sinking. Arrol provided a **temporary bridge** (1924) and the old one closed. It re-opened after repairs but was eventually demolished and replaced by the present structure (official opening 1945). Arrol's temporary bridge was demolished in 1943.

Other British bridges of the 1920s that Hunter worked on include six road bridges, three railway bridges, two rolling lift bridges and a swing bridge. For the 1927 **Newport Bridge** in Monmouth, to keep traffic flowing during construction Arrol re-used the temporary crossing they had built for Southwark Bridge. The company's best-known bridge from this period is probably the three-pin steel arch **Wearmouth Bridge (1929)** in Sunderland, again designed by Mott, Hay & Anderson.

In another vein, Arrol, with Hunter in charge, constructed **Barton Power Station** in Manchester (1920-3) and **Stonebyres Hydroelectric Power Station** and pipeline, which is part of the **Lanark Hydroelectric Scheme** (1926-27, engineer: Buchan & Partners). Arrol's site agent for the Lanarkshire scheme was reinforced concrete pioneer **Guy Maunsell** (1884-1961).

Alongside reconstruction work on the **South Esk Viaduct** at Montrose in Angus, and **New Holland Pier** in Lincolnshire, Hunter's projects in the UK included three caisson schemes and three dock gate contracts. He also worked on the construction of factories, shipyards and industrial premises, though not as many as Arrol had built in the period 1900-10. From 1917-29 there were ten such projects in the UK, one in Nigeria and one in New Zealand.

Around 1920, Arrol began work on an automatic wagon tipper and discharging hopper for **Takoradi Harbour** (built 1921-8) in western Ghana. There were also sea lock gates for the **Johore to Singapore Causeway** in 1922, a large pontoon for landing coal at **Athens Power Station** (c1927), and lock gates for **Kidderpore Docks** in Calcutta, India (1928), and for **Nag Hammadi Barrage**, Egypt (1929).

Arrol's crane designs were much in demand in the southern hemisphere. The company supplied a moving crane with a lifting capacity of 25 tonnes to South Africa in 1924. A pair of 81 tonne capacity steam-powered floating cranes were constructed for New Zealand, mounted on steam ships built by Fleming & Ferguson Ltd of Paisley, Renfrewshire. The steam ship *Hikitia* (constructed 1925) went to Wellington Harbour and is still operable, though now powered by diesel. The *Rapaki* (1926) worked in Lyttelton Harbour until 1988, and is now preserved at the New Zealand Maritime Museum in Auckland.

However, most of the overseas projects Hunter worked on were bridges, starting with a railway bridge at Erode in Tamil Nadu, India. He visited Makurdi, Nigeria, in 1921 to assess the site and design the 800m long **Benue Rail Bridge** (constructed 1928-32). This was followed by the **Nabkoi Viaduct** near Ainabkoi in Kenya's southern Rift Valley, for the Uganda Railway (so called because it goes to Uganda, though it is entirely within Kenya) around 1922.

Between 1924-9, Hunter worked on ten other railway bridges — two in Ghana (**Offin River Bridge** at Amoako and **Prah Bridge**), **Morhar Bridge** at Gaya in India, two for

Sudan Railways, two at Buenos Aires in Argentina and two for South African Railways (including **Zwartkop River Bridge** in Pretoria).

Other bridges included the **Johore to Singapore Causeway Lift Bridge** (causeway built 1919-23) and the **Nag Hammadi Barrage Swing Bridge** (barrage built 1927-30). In Uganda there was a combined bridge for road and rail traffic, and one in Nepal for road and light railway use.

So, the 1920s were filled with work for Hunter — it would prove to be the peak of his career. Although we know little of anything else that was going on for him in these years, the next decade was to start well in relation to his home life, with the marriage of his daughter.

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The 1930s cut short

The 1930s began with the celebration of marriage of Adam Hunter's daughter, Ruth Whiting Hunter. She married Ian Sinclair Phillips (1905-64) on 23rd June 1930 at the University of Glasgow's memorial chapel, in a Church of Scotland ceremony. The groom was the son of Scotsman James William Phillips (1873-1934), and was living at 8 Endsleigh Street in London at the time of the wedding. The newlyweds moved into a semi-detached house at 22 Windermere Avenue, Wembley, Middlesex.

On the work front, the end of the 1920s and beginning of the 1930s was as busy as ever for Hunter. He remained a director of Sir William Arrol & Co Ltd.

The company was well known for its rolling lift bridges, and Hunter was responsible for three built between 1928-31 at Birkenhead Docks on Merseyside. The bridges — at Duke Street, Tower Road and Egerton Wharf — were similar in design, with raised control houses and Scherzer lift mechanisms, which had been invented and patented by brothers William (1858-93) and Albert H. Scherzer (1865-1916) of Chicago. Only **Tower Road Bridge** remains in regular use. Another rolling lift bridge with a Scherzer mechanism was built at Shadwell Dock basin in London.

Two more of the iconic giant cantilever cranes were installed too, one with a lifting capacity of 254 tonnes at the Walker Shipyard in Newcastle upon Tyne (1929-31) and one of 178 tonnes at Stobcross Quay (Finnieston) in Glasgow (1932), though Arrol provided only the foundations for the latter.

Hunter was working on projects in Britain and overseas, though there were fewer overseas projects than formerly. Between 1930-3 he was concerned primarily with bridges, and all six foreign contracts in that time were for bridges, as were 22 of the 29 schemes he worked on in the UK.

In 1930 and 1933, he worked on projects in the Caribbean, Africa and the Middle East. These included road and railway bridges in Jamaica, **Tsoelike Suspension Bridge** carrying a road in Lesotho, and cylinders for **Mosul Bridge** in Iraq.

In Scotland, Hunter and Arrol were busy with five opening bridges over the **Forth & Clyde Canal** and three swing bridges over the **Caledonian Canal**. The Caledonian Canal bridges all carry the A82 in the Highland region — at Laggan, Aberchalder and Fort Augustus.

The Forth & Clyde Canal had three steel bridges in Glasgow, all operated electrically — **Balmore Road Lift Bridge** in Lambhill, which replaced a timber bascule bridge; **Boulevard Lift Bridge** (demolished 1968) carried Great Western Road; and **Temple Lift Bridge** (replaced by the present four-lane bridge) carried Bearsden Road. There were two other Arrol-constructed bridges, both now demolished — **Townhead Swing Bridge**, removed when the canal was culverted at Kirkintilloch, Dunbartonshire (culvert now replaced); and **Dalgrain Swing Bridge** in Grangemouth, which carried Glensburgh Road (replaced by the present non-opening Kerse Bridge).

Other canal-related projects included **Westquarter Swing Bridge** over the Union Canal at the Imperial Chemical Industries Ltd (Nobel) factory near Polmont in Falkirk — close to the home of Scottish railway engineer John Miller (1805-83).

Arrol also installed lock gates and five swing bridges on the **Manchester Ship Canal**. West to east, the bridges are **Old Quay Bridge** in Runcorn, and in Warrington **Chester Road Swing Bridge**, **Moore Lane Swing Bridge** carrying Northwich Road (now Wilderspool Causeway) and **Knutsford Road Swing Bridge**.

Hunter was responsible for the construction of four railway bridges and four road bridges at this time, including the reconstruction of **Streatham Road Rail Bridge** in London. The road bridges included **King's Bridge** over the River Clyde at Govan in Glasgow, and **Rossie Island Road Bridge** at Montrose in Angus, Scotland. There was also more work for Hunter at the Royal Navy Oil Terminal at Lyness on Hoy, Orkney, where he had worked at the start of World War I.

He was involved too in the construction of factories and industrial works. From 1917 to 1932 he worked on nine such projects, five in Scotland and four in England.

However, tragedy was just around the corner. In 1932, Hunter first felt the affects of the illness he contracted that was to prove fatal all too soon — its nature is unknown. He resigned the post of Chief Engineer and stepped down from his directorship but he continued to work as a consultant for Arrol.

One of the last projects he worked on, in 1933, was the large-diameter 488m steel pipeline designed to carry water from the tunnel leading out of Clatteringshaws Loch to the **Glenlee Hydroelectric Power Station** in Galloway (built 1931-35).

Adam Hunter died on the 1st November 1933, at home — *The Grove*, a large detached house at 34 Buchanan Drive, Rutherglen, south east of Glasgow. He was survived by his wife Lottie and daughter Ruth. He was 64 years old.

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An appreciation

At the time of Adam Hunter's death in 1933, he was acknowledged by his peers as one of the great structural steelwork engineers. Harry Cunningham (1877-1952), a Director of Sir William Arrol & Co from 1913, and its Chairman from 1935, wrote in 1950 that from 1909 onwards, "the most important member of staff was Mr. Adam Hunter, Chief Engineer".

Though not as well known to modern engineers as William Arrol himself, Hunter's legacy endures in the many structures he designed and built that survive in use today. Of more than 200 works in which he played a key role in his 47 year career with the company, Hunter was responsible for 91 bridges, 52 industrial premises and 20 large-scale cranes. His other projects included power stations, lock and dock gates, and viaducts and caissons.

His notable achievements include work on three Thames bridges in London — the 1907-8 reconstruction of **Blackfriars Bridge**, the new **Southwark Bridge** (1920-1) and the provision of a temporary structure for Waterloo Bridge (1924-34).

Hunter followed William Arrol's lead in developing prefabrication techniques, enabling the construction of complicated structures to be simplified considerably. This proved a particular advantage for overseas projects — custom-made sections were exported, and assembled and erected on site. He explained his methodology in his most influential publication, *Bridge and Structural Engineers' Handbook* (1920, reprinted 1928), which was a standard text for more than 60 years.

There is no record of his character from the viewpoint of his family and we must rely on hints at his pleasant nature from some of his obituaries. *The Structural Engineer* asserted that "his loss will be deeply felt by his colleagues and many friends". His mentoring skills were highlighted in *The Engineer*, which stated that "younger engineers owed much to his kindly advice and help, which was often sought and was never refused".

Dr Jim Shipway, consulting engineer and historian who worked at Arrol 1948-53, recalled in a memoir of 2004, "In the past Arrol had had a brilliant chief engineer and director, Adam Hunter MICE ... Apart from Sir William Arrol himself, Adam Hunter was probably the most able member of all the firm's staff".

Hunter's obituary in the *Glasgow Herald* states that "He was regarded as an authority on bridge building, and was repeatedly consulted by engineers in all parts of the country". In *The Structural Engineer* he is described as "one of the best known civil engineers of his time, and he was widely recognised as an outstanding authority on bridge building".

Perhaps the last words should be taken from the *Transactions of the American Society of Civil Engineers* (1934), where it says simply that he had "a generous and genial disposition" and "was very highly esteemed by all who came in touch with him, not only for his great professional ability, but for his sterling worth and amiable personality".

Hunter is commemorated on a plaque to be unveiled at the **Titan crane** on Clydebank in August 2013. Fittingly, this is a joint venture between the Institution of Civil Engineers and the American Society of Civil Engineers.

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Hunter's professional affiliations

Throughout his career, Adam Hunter joined professional organisations that provided useful opportunities for networking with engineers and other like-minded colleagues. When he was 22 years old, in 1891, he became a member of the Junior Engineering Society, which was founded in 1884 and renamed the Institution of Junior Engineers in 1893. He later served as its Vice President.

On 3rd December 1895, he was elected an Associate Member of the Institution of Civil Engineers (ICE), transferring to full Member on 20th April 1909 — the present-day equivalent of Fellow.

In 1906, Hunter became a Member of the Institution of Engineers and Shipbuilders of Scotland (inaugurated 1857) and was later Vice President.

And he did not neglect his connections in the USA. He was elected an Associate Member of the American Society of Civil Engineers on 6th September 1905 and became a full Member on 2nd May 1911.

In 1910 he was awarded the ICE's Telford Medal and Premium for a joint paper with Associate Member Francis Charles Buscarlet (1866-1958) — *Queen Alexandra Bridge over the River Wear, Sunderland*. One of the books he chose as his prize was the 1902 classic on bridges, *Croquis de Ponts Metalliques* by Jules Gaudard (1833-1917).

He was elected a Member of the Institution of Structural Engineers (IstructE) in 1923, and also served on its council.

His 1929 keynote paper, *Erection of Metallic Bridges*, to the institution was considered by its then President, Lt Col John Mitchell Moncrieff CBE (1865-1931), to be of "inestimable value to the young members of the profession" and his overseeing of the new Wearmouth Bridge, a replacement for the historic Sunderland Iron Bridge of 1796 was "a very clever piece of work".

Hunter was President of Glasgow University's Engineering Society. In 1925, he was also President of the ICE's Glasgow Association of Students (founded 1884, later renamed Glasgow & West of Scotland branch).

His opening address to the Association on 18th November 1925 — *The Construction of Bridges* (published 1926) — is an accomplished review of bridge engineering development from the Roman bridge over the Danube of AD105, between present-day Serbia and Romania, onwards.

Hunter was also a member of the Royal Philosophical Society of Glasgow, the Liberal Club of Glasgow and the Engineers' Club of London. He served on a number of British Engineering Standards Committees, including the Committee on Bridge Loads and Stresses.

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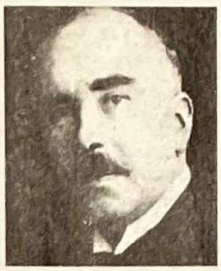

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Selected works

1886-9	Apprentice pupil with Tancred, Arrol & Co., **Forth Bridge** Works, South Queensferry
1889	Moves to Sir William Arrol & Co. Ltd.'s London office (December)

ENGINEERING ASSISTANT, SIR WILLIAM ARROL & CO LTD

1889-95	Works on steelwork design/erection projects, including **Tower Bridge**, **Brighton & South Coast Railway**, **Shoreham Viaduct** and swing bridges in London docks
1890-93	Attends evening classes, City of London College
1895	Promoted to Chief Assistant Engineer

CHIEF ASSISTANT ENGINEER, SIR WILLIAM ARROL & CO LTD

1895	Working on bridges at Durban, Aberfeldy, Barnstaple, Aldershot and Nittinghsill ... and power stations at Bow and Willesdon (London), a crane at Dalmuir, workshops at Poplar (London) and a bakery in Fulham
1904	**Swale Rolling Lift Bridge**, Isle of Sheppey, Kent
1904	**Electric derrick crane** (152 tonne), for John Brown & Co, Clydebank (demolished)
1904	Working on three Nile bridges in Cairo, Egypt, and the **Suakin-Berber Railway** in Sudan
1904-05	**Dalginross Bridge**, Comrie, Perth & Kinross
1905	Working on workshops for shipbuildiers Cammell Laird at Tranmere, Birkenhead, and the Caledonian Railway's **New Clyde Viaduct**, (engineers: Sir John Wolfe Barry, Donald A. Matheson)
1905	Working on projects in Ireland: **Rosslare Harbour Viaduct** and **Barras Swing Bridge**, Waterford
1905-06	Acting Chief Engineer (July 05 to November 06)
1905-06	Technical adviser on site for the three Nile bridges (see above)
1905-08	**Jubilee (Walney) Bridge** (engineers: Sir Benjamin Baker, A.C. Hurtzig, E.M. Wood) Barrow-in-Furness, Cumbria
1906	Working on workshops for North British Locomotive Co Ltd, Polmadie, and shop erection for Coventry Ordnance Works Ltd, Scotstoun — both in Glasgow
1906	Working on three railway bridges in Glasgow: **King Street Bridge** , **Nelson Street Bridge** and **Wallace Street Bridge**
1906	**Suir Bridge**, Waterford, Ireland
1906-07	**Titan crane** for John Brown & Co, Clydebank
1906-07	Workshops and crane gantry over dock for Yarrow & Co, Glasgow
1906	Appointed Chief Engineer, works from Arrol headquarters at Dalmarnock Iron Works, Glasgow

CHIEF ENGINEER, SIR WILLIAM ARROL & CO LTD

1907-08	Working on the reconstruction and widening of London's **Blackfriars Bridge**
1908	Working on the Dowie & Co works at Port Siad, Egypt
1909	Conveyor plant for extracting oil from shale spoil heaps, Addiewell, West Lothian, and cranes and overhead steelwork for a slipway at Harland & Wolff shipyard, Belfast
1909	Working on the **Assiut Barrage Lift Bridge** (Assuit, Assyut), Egypt, and a lift bridge and lock gates for Jebel Aulia Barrage, Sudan
1909	Swing bridges: **Forth & Clyde Canal Swing Bridge** (Kilbowie, Clydebank), **Stockton Heath Swing Bridge** (Manchester Ship Canal) and **Kings Dock Swing Bridge** (Swansea)
1909	**Brunel Way Rolling Lift Bridge**, Swansea
1909	Works in relation to **Waverley Station** and nearby **North Bridge**, Edinburgh
1909-10	Two giant cantilever cranes for North Eastern Marine Engineering Co, Wallsend, Tyne & Wear (demolished)
1910	Appointed Director, Sir William Arrol & Co Ltd

DIRECTOR, SIR WILLIAM ARROL & CO LTD

c1910	**Tapti Railway Bridge**, Great Indian Peninsula Railway, Mahashtra, India
1910	Gate for **Alexander Dock**, Newport

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