Robert Stevenson (1772-1850), by John Syme, *c.*1833

Stevenson, Robert (1772-1850), civil engineer, was born in Glasgow on 8 June 1772, the only child of Alan Stevenson (1752–1774), a West India merchant, and his wife, Jean Lillie (1751–1820). Two years later his father died of fever in St Kitts, leaving his family in straitened circumstances, and Stevenson was educated at a charity school in Edinburgh. In 1786 he was apprenticed to an Edinburgh gunsmith and was himself described as a gunsmith about 1791. At about that time he began work for Thomas Smith (*bap.* 1752, *d.* 1815), an Edinburgh tinsmith, lampmaker, and merchant who, following his invention of a light reflector, had been appointed engineer to the newly formed Northern Lighthouse Board in 1787. Smith married Stevenson's mother in 1792 and became his father-in-law when Stevenson married his daughter Jane (*c.*1779–1846) on 3 June 1799.

During the winters of 1792–4 Stevenson attended Professor John Anderson's classes in natural philosophy at Glasgow University and was directed by him towards an engineering career. From 1796 until 1802 he was apprenticed to Smith, specializing in lighthouse work, and gained experience on reflector installation, building maintenance, and construction of the Pentland Skerries and Little Cumbrae lighthouses. From 1797 Stevenson exercised considerable autonomy in the firm's lighthouse work including the construction of Inchkeith and Start Point lighthouses. By 1802 he had been taken into partnership by Smith, whom he succeeded as engineer to the board in 1808. During the winters of 1800–04 Stevenson continued to develop an engineering career by attending classes at Edinburgh University in mathematics, natural philosophy, chemistry, and natural history. During this period he was also trying to gain approval for the Bell Rock lighthouse project 11 miles off Arbroath, which was to prove his most important engineering achievement.

In 1799, following a storm in which many ships were wrecked, Stevenson had proposed erecting on the Bell Rock a beacon-style lighthouse on cast-iron pillars but in 1800, after seeing that the rock was submerged by about 12 feet at each high tide, and considering the possibility of damage by ships, he abandoned this idea in favour of a more substantial lighthouse to be made of stone. As part of the design and promotional process for the project both designs were accurately modelled, a practice which Stevenson often employed subsequently on important work. Because of the hazardous and expensive nature of the project it was only after the board had obtained the support of the eminent engineer John Rennie in 1805 that the necessary act of parliament was passed in 1806. Rennie was appointed chief engineer and with Stevenson acting in effect as resident engineer the lighthouse was constructed in 1807–11. The great achievement of the work was in the exceptional difficulty of its execution, which was carried out by Stevenson and his dedicated workmen, rather than in its design which at Rennie's insistence was more closely modelled on Smeaton's Eddystone lighthouse than Stevenson's proposal, particularly in respect of its external shape. Stevenson also had been strongly influenced by the Eddystone design and improved on it in detail with cantilevered and bonded instead of flat-arched floors to compartments, an

innovation widely adopted in subsequent rock lighthouses. Rennie recognized the importance of Stevenson's role when writing to him in 1807 that the work 'will if successful, immortalise you in the annals of fame' (Stevenson, Biographical Sketch, 10). Innovations introduced under Stevenson's direction included the temporary beacon barrack, elevated cast-iron railways across the rock, and the ingenious movable jib and iron balance cranes, which records indicate were invented by foreman millwright Francis Watt who also designed the barrack as built. The success of the work enabled Stevenson, from 1811, to establish within a decade one of Scotland's leading indigenous civil engineering practices, which, with his descendants, practised engineering continuously until 1952. His classic Account of the Bell Rock Light-House was published in an edition of 300 copies in 1824 and he can be considered to have attained the first rank of his profession shortly thereafter. The lighthouse was still in service in 2003, but unmanned.

As engineer and chief executive to the Northern Lighthouse Board in 1808–43 Stevenson can be said to have inaugurated the modern lighthouse service in Scotland. He designed and constructed at least eighteen lighthouses including Toward Point (1812), Isle of May (1816), Corsewall (1817), Point of Ayre and Calf of Man (1818), Sumburgh Head (1821), Rhinns of Islay (1825), Buchan Ness (1827), Cape Wrath (1828), Tarbat Ness and Mull of Galloway (1830), Dunnet Head (1831), Douglas Head (1832), and Girdle Ness, Barra Head, and Lismore in 1833. On lighthouse illumination Stevenson developed Smith's work and brought the catoptric system, using silvered copper parabolic reflectors and Argand lamps, to a high degree of perfection. With the increasing number of lights it became necessary to distinguish between them, and to this end he devised intermittent and flashing lights.

Marine engineering represented the largest element of Stevenson's general practice. He proposed improvements at numerous harbours including Dundee, Peterhead, Stonehaven, Sunderland, Fraserburgh, and Granton, and navigation schemes for the Forth, Tay, Severn, Mersey, Dee, Ribble, Wear, Tees, and Erne. Many of these proposals were implemented. He also reported on ferry crossings of the Forth, Tay, Dornoch and Pentland firths, and the Severn, and on fisheries. Stevenson's innovative marine work included the design and construction in 1821 of a sea wall with a cycloidal-curve vertical profile which dissipated wave energy more effectively than common walls, and experiments on the destruction of timber by the *Limnoria terebrans* which influenced the universal adoption of greenheart for marine timberwork. His discovery at Aberdeen in 1812 that salt water from the ocean flowed up river in a distinct layer from the fresh water which overflowed it, led to his invention of the 'hydrophore' or water sampler for procuring samples, to further experiments, and to his Royal Society of Edinburgh paper on vertical differences of salinity in water in 1817. His observations upon the floor of the North Sea, delivered to the Wernerian Society, were published in 1817 and 1820. Stevenson was joined in partnership of the firm by his sons Alan Stevenson, about 1832, and David Stevenson, in 1838. Thomas Stevenson became a partner in 1846 on his father's retirement.

From 1811 to 1827 Stevenson was extensively engaged on canal, road, and railway projects, often adopting a promotional role. Before 1818 he made proposals for canals on one level between Edinburgh and Glasgow and also in the Vale of Strathmore. In 1828 he worked with Telford and Nimmo on a proposal for a new harbour at Wallasey and a ship canal across the Wirral to the Mersey. None of these schemes was executed but he was more successful with road making and in his advocacy of stone tracks in city roads. By 1818 Stevenson was convinced of the superiority of railways over small canals for inland communication and proposed the Edinburgh Railway to connect with the Midlothian coalfield. In 1819 he advised on the line for the Stockton and Darlington Railway. By 1820 he was the leading authority on horse-traction railways in Scotland and he edited with notes the numerous 'Essays on rail-roads' submitted to the Highland Society, which were published in 1824. By 1836 he had worked out various railway schemes to traverse eastern Scotland from the Tweed to Perth and Aberdeen, and from Edinburgh to Glasgow via Bathgate, more or less on the lines of the eventual railway network, but the financial climate was unfavourable and the necessary finance for their implementation was not

forthcoming. The only scheme actually constructed was the short Newton colliery Railway to Little France near Edinburgh. Stevenson's design practice was basically the same as he had adopted for canals: to plan his railways as near level as practicable, using stationary steam-engine powered inclined planes to overcome differences in level. In 1818 he advocated the use of 12 feet long malleable iron edge-rails in preference to the much shorter and weaker cast iron rails then prevalent. Three years later George Stephenson, in acknowledging Stevenson's influence on Birkinshaw's epoch-making development of the malleable iron forerunner of the modern steel rail, wrote to him 'you have been at more trouble than any man I know of in searching into the utility of railways' (Stevenson, Biographical Sketch, 27).

Stevenson was also a notable bridge engineer and highway planner. He designed and constructed many bridges throughout Scotland including, over the Clyde at Glasgow, Hutcheson Bridge (1832–68) and a temporary but notably wide fourteen-span timber bridge (1832–46). The former, which had to be replaced because of Clyde navigation deepening, was considered one of the best specimens with segmental masonry arches. So was Stirling Bridge, which still stands, and for which Stevenson also planned its town approach. This approach is not as imposing as his earlier London and Regent Road approaches into Edinburgh skirting Calton Hill, which included the Regent's Bridge with its open parapets to enable users to enjoy the view. He was also responsible for making these roads which involved blasting, rock excavation, and a massive retaining wall.

Segmental arches characterize Stevenson's masonry bridges, fine examples of which still exist at Marykirk, built in 1812, and Annan, 1824. He adopted segmental arches in major proposals for cast iron additions to Newcastle upon Tyne, Perth, and Edinburgh North bridges, but none was executed. Stevenson's innovative designs for other kinds of bridges included a laminated timber arch for Dornoch Firth in 1830 and, from 1821, a new type of medium-span suspension bridge without towers which he proposed for numerous locations. This design was novel in that the roadway superstructure rested on the catenarian chains rather than being suspended from them. It was widely publicized in Stevenson's authoritative 'Bridges of suspension' article published in the Edinburgh Philosophical Journal in 1821, which was translated into French, German, and Polish. Numerous small-span bridges on this basic principle were subsequently executed in Britain and on the continent by 1850. Although not implemented as intended, Stevenson's proposals, together with details of his Glasgow and Stirling bridges, were widely disseminated through John Weale's The Theory, Practice and Architecture of Bridges from 1839 and undoubtedly influenced subsequent bridge-building practice nationally. More unusual structures upon which Stevenson advised were the cracked steeple of Montrose church, Arbroath Abbey, and the Melville monument in Edinburgh.

Stevenson had a lifelong interest in gaining and promoting knowledge and his writings appeared in more than sixty publications. Many were engineering reports, but about one-third achieved much wider circulation through leading periodicals and encyclopaedias. He contributed significant articles to the Edinburgh Encyclopaedia between 1810 and 1824, entitled 'Bell Rock', 'Eddystone rocks', 'Inchkeith', 'Light house', 'Roads and highways', and 'Railway'. To the Encyclopaedia Britannica between 1816 and 1819 he contributed 'Bell Rock light house', 'Blasting', 'Caledonian Canal', and 'Dredging'. In 1817 he wrote a lively and informative series of letters to his sixteen-year-old daughter, Jane, while on a tour through the Netherlands; these were of sufficient interest to be published in the Scots Magazine in 1818–21 and separately as Journal of a Trip to Holland in 1848. Many of Stevenson's publications, because of their depth and authority, now represent a valuable historical resource. His membership of learned societies seems to have commenced with that of the Highland Society in 1807. By 1812 he was a member of the council of the Wernerian Natural History Society and in the following year a founder director of the Astronomical Institution of Edinburgh. In 1815 he was elected to fellowships of the Royal Society of Edinburgh, the Geological Society, and the Society of Antiquaries of Scotland. Six years later he became a founder member of the Scottish Society of Arts and in 1827–8 was elected respectively to membership of the Smeatonian Society of Civil Engineers and the Institution of Civil Engineers.

Prominent points of Stevenson's character noted by his sons were sagacity, fortitude, perseverance, unselfishness, generosity, a high sense of duty, and extensive and unwearied exertions in forwarding the progress of young professional men. He was a member of the Church of Scotland and an elder, first at St Mary's, Edinburgh, from 1828–43 and afterwards at Greenside parish church. He died at his home, 1 Baxter's Place, Edinburgh, on 12 July 1850 and was buried in the new Calton cemetery. An affectionate portrait is given by his grandson (Stevenson, Records).

Roland Paxton

Sources

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Archives

NL Scot., business records of Robert Stevenson & Sons, Acc. 10706

Likenesses

J. Syme, oils, *c.*1833, Scot. NPG [*see illus.*] · T. Dick, engraving, *c.*1840 (after J. Syme), priv. coll. · S. Joseph, marble and bronze bust, Northern Lighthouse Board, 84 George Street, Edinburgh · S. Joseph, plaster bust, Scot. NPG · plaster bust (after S. Joseph), Scot. NPG

Wealth at death

£15,154 13*s.* 5*d.*: NA Scot.

Roland Paxton, 'Stevenson, Robert (1772-1850)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [accessed 4 Oct 2004: http://www.oxforddnb.com/view/article/26436]

Back to top of biography

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