

Chapter Four

David Stevenson 1815-1886 - River improver and consolidator of the dynasty

Family recollections

Born in Baxter Place, like all the second generation, David went to the High School in October 1824 and spent six years there. It was then still in Infirmary Street and moved to its New Town site in 1829. He was only able to enjoy its proximity to his home in Baxter Place for one term. Lessons came easily to him and he won many prizes. His father encouraged him to study subjects other than the Latin and Greek which would have enabled him to get a university degree, and although this never appeared to detrimentally affect his career as an engineer, it was a decision he later regretted.

A natural writer, throughout his life he was to take copious notes of details on his travels useful to him to recall or make a point. He wrote a diary which his father required him to keep of his first voyage to the northern lighthouses when he was thirteen years old. The trip in August 1828 was aboard the *Regent* and lasted for a month. David's diary is neatly written, although the handwriting gets a little wobbly when the seas were rough, and it is full of lively character and keen observations. Two young cousins, Alexander and William Swan, were with him. There was no favouritism shown to the children and all the passengers were expected to lend a hand with the crew, who numbered fourteen.

[August 1828] Monday 18. Embarked at Newhaven in the *Regent* tender boat at six P.M. with our party consisting of Mr Moconochie, Mr Bell, Mr A. Cuninghame, Mr Reid, and my companions, Mr A. Robertson, and my cousins A. and W. Smith with my father being on his annual voyage to the Lighthouses. Our gallant ship being under the command of Captain Soutar. Her cargo consisting of the apparatus for the

Lighthouses now building at Cape Wrath. The *Regent's* tonnage is 141 tons Register though she is only at present half loaded.

On our way down the Firth we landed at the Island of Inchkeith and were very much gratified with a view of the Lighthouse. Mr Bonnyman the principal keeper was very attentive in shewing us all his apparatus. He was one of the masons at the building of the Bell Rock Lighthouse in 1809 when he had the misfortune to lose one of his fingers. We here also met with an old Lighthouse Pilot of the name of Noble who had had 20 children. On being asked by my Father how a certain pleasure boat sailed he replied "Sail Sir, how the Devil could she sail, when the party played at the *Cairts* [cards] on the sabbath day." After leaving Inchkeith we had a very pleasant sail toward the Isle of May and with the help of the moon we could see the coast of Fife and before going to bed we had both the revolving light of Inch Keith and the stationary light of the Isle of May distinctly in view. Tuesday 19th. After seeing the Lighthouse [on the Isle of May] which here is upon a grand scale we took a walk round the island. The first thing pointed out to us was a precipitous part of the rock on the western side of the island where our incautious and importunate Pointer slipped his hold while scrambling for birds nests and eggs and falling into the water he was afterwards found quite dead with a severe contusion on his head. After winding up a curious *zig-zag* path we reached the top of the island and approaching another precipitous face of rock we contrived by shouting, clapping hands, and throwing stones, to put thousands of sea gulls to flight. But although they almost darkened the sky Mr Pithe the light keeper assured us that the major part of the birds had

left the island with their young so that what we saw were chiefly the herring, and laughing, gulls, the Marrot [marrott; guillemot] and Picktarnie [picketarnie; pictarnie; tern] having already migrated. In the course of our walk we visited two insulated columnar masses of rock measuring about 30 or 40 feet in height called the *pilgrims*. We also coasted round *Pilgrims bay* and went to the *Bishops well* and visited the Chapel, and then after embarked in our boat from the ship under the Pilotage and guidance of our worthy friend and galant commander Captain Soutar. In approaching this curious and kind of sacred island we entered by *Kirken Haven* and left it by *Monks Wick*. It may be remarked that all the names such as *Altarstones* &c have reference to the church, the Chapel here having in former times been a dependency of the Monastery of *Pittinweem*. But from this and other particulars my father refers us to Sybalds history of Fife.⁷⁵

Towards the end of the voyage they arrived at Largs:

'Later that day we anchored opposite the church of Largs in 20 fathoms and took a view of this overgrown village. Its resident population numbers perhaps 2,000 people, for such are the facilities afforded by the numerous steamboats upon the Clyde that Largs and its immediate neighbourhood contain handsome marine villas which are occupied by the citizens of Glasgow during the bathing season. In my father's recollection it consisted of a few thatched hamlets.

At an early hour next morning the Captain and the crew were astir and set up the rigging of the ship which, owing to the continued drought, had become slack: for the support of the mast in gales of wind it is of consequence to have the

rigging set tautly up. Here our forecabin friends-the Commissioners-left us with the dog Hew to join the *Albion* steamer leaving for Glasgow.⁷⁶

The *Regent* then sailed for the Isle of Man where the lighthouses at Point of Ayre and Calf Island; were inspected. David noted that over 300 boats were employed at the Manx herring fishing, each with 8 or 9 seamen, but that the herrings seemed to have shifted their ground and had become very scarce. On the small Calf Island

'our dog Dickie killed a rabbit, a circumstance which gave my father regret. Some of us minor folk thought a single rabbit would never be missed among the hundreds that were seen which led to some remarks tending to contradict our views with regard to the right of property.

On coming on board at the Point of Ayre we had all expressed a desire to know where we were now bound but we had the old answer of 'we know nothing on this ship'. [A standard joke in the lighthouse service.] We must confess that we now look with a certain kindness towards *Auld Reekie* and my father acknowledges that this desire is considerably increased from a late falling off in the dessert. We have not had for some days the full display of figs, raisins, prunes and almonds, the steward having been able to supply our dessert plates with only two kinds of dried fruit. It is further charged against us that visages became lengthened when the steward announced that we had just finished the last can of jelly. Perhaps it was for these weighty considerations that the ship now turned homewards and we were happy to find that we should soon sail up the Clyde towards Glasgow.⁷⁷

Next year David went on another lighthouse voyage. Robert took him and his brothers, Alan, and twelve year old Tom, on the journey. Not only did they visit Scotland, but this time the boat went to Wales and Ireland as well. A storm, which kept the travellers at Lerwick and off Kirkwall for six days, would have terrified many adults let alone a 15 year old boy, but seemed to have little effect on David. He had an excellent brain, cool head and steady heart.

Robert recognised David's potential and planned for this second son with great care. He knew the value of a thorough apprenticeship and of learning from basics as he had done. In the autumn Robert took him over to Cupar in Fife, on the 'Defiance' coach, to work for a Mr James Scott, engineer and millwright. David describes how he worked 'in moleskin jacket, ... first at wood and then to some extent at iron work.' In those days much of the machinery, particularly connected with agriculture, was made of wood and so the business of millwright was often combined with engineering. He was lodged with a 'respectable widow' and installed as his 'own master.' David writes that 'a box passed to and fro' from Edinburgh once every fortnight bringing sundry edibles, but nevertheless my housekeeping in lodgings was very indifferent. I dined often on sausages or Finnan Haddock and had a headache almost every day'. David grew to a height of only 5 foot 8 inches and possibly this spartan diet had something to do with it! In the early miniatures done of him and without wearing his spectacles he was a very handsome young man, always well dressed.

It is obvious, reading from his account, that David was very homesick and therefore delighted when Mr Scott sent him off to fit up new machinery at the flax spinning mills of Malleny

which were only 8 miles from home. He could walk into Baxter Place on a Saturday and return on the Monday.

He writes of two hair-raising incidents at Malleny:

'Once, on walking to Edinburgh and coming down the steep road to Currie which is bounded by hedges on either side, a gun was fired and the bullet *whisked* past me, evidently within a yard of my head. Supposing it to be some boys firing a pistol I at once sprang up on a small embankment to shew myself above the hedge and prevent another discharge, when I found to my dismay that the bullet came from two men in the field at a short distance, who were aiming at a target against the hedge, and *directly* opposite the spot where I was standing. The shooters were not less discomfited than I was and hurried up to learn the result of their carelessness. The ground was covered with snow, the road impassable for carts and I suppose I myself almost the only traveller, and they had presumed that in that forlorn unfrequented farm road they might use any liberty with perfect safety.'⁴⁸

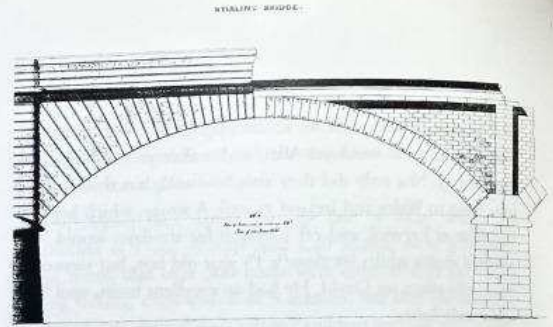
He had a second narrow escape from death with the water wheel, 30 foot in diameter, which still stands at Malleny. Taking a short cut and trying to climb up from the wheelhouse to the flat above via the wheel using the buckets as a ladder landed him in moments of terror:

'The wheel itself was always 'ranced' as it is called, or made fast by beams put through the spokes so as to prevent it from moving while the alterations on the mill gearing were being made. I commenced to *clamber* up the side of the great wheel and had nearly reached the top, when buckets and spokes began slowly to revolve and I saw the whole enormous mass

was in steady motion. I continued to tread with my feet and to clutch with my hands the revolving buckets, but no sooner were they grasped than like a prisoner in the tread mill I found them sink below me and saw that I could not possibly gain the top as the harder I worked, the faster the wheel seemed to go. After a few seconds I decided to take my chance of being able to jump off as I reached the ground. Happily for me a plank had been left across the 'ark' or chamber in which the lower half of the wheel works and I stepped off upon it unhurt. Had the plank not been left there, I must have been carried down with the wheel and if not killed outright certainly seriously hurt.⁴⁸

Terrified that his mates might have lost arms or legs when the wheel started to move all the heavy machinery inside the mill, David lost his nerve to confront the boss and slipped out of sight behind some trees. He observed his workmates coming out of the mill blaming each other for not rancing the wheel following some work that had been done earlier in the day! The wheel had been left standing as it had stopped with its buckets full of water, and David's weight was all that it had required to set it in motion again. Mr Scott and his men, hearing of his narrow escape, were in fact horrified at the neglect of the wheel.

His apprenticeship to Robert, like his brother Alan's, was formidable. It encompassed everything from the surveying of harbours and rivers, railway works at Coventry and railway tunnelling at Liverpool, road building in Ireland and lighthouse construction in all its various stages. At the age of 16, he was sent to the bridge works at Stirling where he was taught to dress stones [52] and later to Glasgow. But practical experience on its own was not enough. From 1831 to 1835, David also attended



[52] *Stirling Bridge drawing from Robert's office, c. 1829, re-drawn 1841. Young David helped to dress at least one of the variable depth, greenstone, archstones.*

Edinburgh University, studying with Professors Wallace, Forbes, Hope, Jameson, Low (agriculture), and D. B. Reid (practical chemistry, etc.). In his free evenings he went for classes in drawing and mathematics, and if there was any extra time after that, he spent it in the office learning the family business. While still an apprentice, he had amassed sufficient knowledge to deliver the first of several papers to the Society of Arts in Scotland.

Two weeks later, after his apprenticeship was finished, he was appointed resident engineer in charge of the harbour works at Granton by the Duke of Buccleuch. For this, his salary was £150 per annum. At the same time he was offered a job at the Thames Tunnel in London but neither David's father nor mother relished this idea much and he accepted the job close to home at Granton.

David's appointment to the Duke of Buccleuch was not to last. Before two years were completed he had professional disagreements over the harbour plans which he felt were inadequate, and he was prepared to resign rather than

compromise his views. Robert was delighted to welcome him to the office but first David decided to travel abroad. His brother, Alan, had been to Russia, but America was David's choice. Accordingly he sailed for New York in March 1837 and visited the principal places in the United States and Canada, and afterwards went to France, Italy, Switzerland, Germany and Holland. When he went to America there were no steam Atlantic packets and trips by amateurs were comparatively few. On his return to Scotland late in 1837 he extended his American notes, working sometimes to two and three o'clock in the morning. In 1838 he published the result, his book, *Sketch of the Civil Engineering of North America*. It showed the development of pioneering engineering in the States, the wonderful dawn that was flooding into the New World. He took fresh ideas from this country and came back with much that had a major impact here.

In his book, David restricted himself to professional matters concerning America. He was lucky to arrive at New York because his ship the *Sheffield*.

'was close beset by field ice off the banks of Newfoundland for about 16 hours which, as appeared when she was docked in New York, carried off her false keel and stripped away every square foot of copper off her bottom. Our Captain who had made more than 100 voyages between Liverpool and New York and had never *touched* ice before was in great fear for his ship. As it happened we got clear of ice in what has been called 'the nick of time' as we were overtaken by a hard gale; had it come on a few hours earlier when we were among the ice it would have inevitably sent the ship to the bottom.'

The voyage home was equally dangerous:

'It so happened further that I had rather an unpleasant landing in Europe on my return voyage in the *Francois Premier*, Captain Pell. ... The captain notwithstanding the state of the wind and sea determined at all hazards to get his ship into harbour. He spent the forenoon in arranging his plans, determining to run in and drop his anchors over the bows whenever she was within the pier heads to check her way. Accordingly having slackened our way as much as possible till high water, the *Francois* entered the pier heads which were crowded with people to see the sight. The signal was given to let go the anchors but no sooner had the strain come on the windlass than the whole of it gave way and was carried right over the bows of the ship and curiously enough over the head of the mate who was not in the least hurt. The ship unchecked continued her course up the harbour of Havre striking first one then another ship until she had damaged half a dozen & she herself more than any of them. It was a strange feeling to be standing on the quarter deck of a 900 ton ship under no earthly command of helm or sail, careering through a crowded harbour with tiers of vessels on either side of us. On examination the timber of the windlass was found to be quite rotten and had it been necessary on the previous night with a high sea & heavy gale to drop anchor off a lee shore it is not difficult to predict what would have been the result.'

In his Journal, written from Paris in 1837, David (aged 22) writes:

'... Of Churches, Notre Dame and the Pantheon are splendid

also La Madelene and Lorella are modern. The Louvre Gallery of pictures and sculpture is splendid. The Palais Royale and the shops and cafes which are on a magnificent scale is worthy of notice, as well as the many arcades with which Paris abounds. Taking Paris all in all I am disappointed. There is much that is magnificent combined with a far greater proportion that is wretched. With the exception of the Boulevards there is not a decent street in all Paris. The large gutters in the middle of the street, the want of footpaths and the very close contact with the nose and person with the Butcher shops, eating houses, pawn brokers, etc, makes the walking of the streets a most unpleasant and disgusting pastime. I was much struck in Paris with the seeming want of stamina that is found in the French character. They are a people pleased and delighted with trifles and the very amusements which afforded them the greatest gratification would be looked on by Englishmen as only fit for children. If a man dismounts to adjust his stirrup he will not fail to be encircled, not by a mob of boys-but bearded men gazing with open mouths and seeming quite unconscious of the absurdity either of their appearance or their conduct. Such sights as this are decidedly a characteristic of Paris and Parisians ... They may safely be said to conform to the laws of no religion for the Catholic religion at least in Paris is no religion at all.⁵

When David returned to Edinburgh, he was made a partner in the family firm of Robert Stevenson and Sons. He joined his brother Alan and his father. It was May 1838, and Robert was almost 70. Alan was immersed in plans for the lighthouse at Skerryvore so David was assumed as 'managing partner.' Working well into the night he pulled the firm into profit and

also established for himself a wide reputation as a water engineer. In 1846, Robert finally retired, and Thomas Stevenson succeeded him, the firm being renamed D. & T. Stevenson. Alan had renounced his nominal partnership to concentrate exclusively on his position as Lighthouse Engineer to the Commissioners.

As Alan gradually became unable to carry out his duties as lighthouse engineer through ill-health, David and Thomas combined to take the weight of work from him. They built 29 new lighthouses round the Scottish coast between 1854 and 1880 including Dhu Heartach. The Stevenson name was now known world-wide and orders for lighthouses and technical expertise came from Burma, Japan, New Zealand, Australia and Canada. Because of David's depth of understanding of mathematics and science he was able to work in areas of new development. Besides designing heavy machinery, engineers everywhere were experimenting with gas and electricity and the Stevensons had to keep ahead. Robert's great curiosity about every aspect of life had been handed on to his sons and they tackled details of the astonishing variety of work that landed on their desks with scrupulous care. They learnt to be very careful indeed about sharing experimental knowledge with competitors and the riposte 'hush, hush' was a joke in the family for three generations.

But it was not all work for David, because by this time he was a happily married man. He had been particularly fortunate in his choice of Elizabeth Mackay as his life partner. [53] Her brother, Alexander, was a close friend of his, and the Mackay family lived nearby in Forth Street. The first mention of a close friendship between the Stevensons and the Mackay family comes in Thomas Smith's will where he appoints James Mackay,

junior, Goldsmith in Edinburgh, as one of the trustees for the disposition of his estate. As teenagers, David and Elizabeth had spent much time together and had carved their initials on a tree on the banks of the River Forth at Stirling. She was 14 years old, he was 16. They became engaged before David started his job at Granton and married on 3 June 1840. There is an embossed leather album, given to Elizabeth by her mother for a new year gift in 1836, which is filled with drawings and scraps showing how much she was in love with David. Her future brother-in-law Alan has written into it several verses for her.

David and Elizabeth lived for the early years of their marriage at 12 Union Street. Their daughters, Elizabeth, Jane, Georgina and Mary were born there. Another child called Georgina Burke, a niece of Elizabeth Mackay, was adopted at birth when her father was lost at sea and her mother died a few weeks later. She was known as 'Gina', to distinguish her from Georgina Stevenson. By 1850 they had moved to 8 Forth Street and Elizabeth had the son they wanted so much, Robert James.

It was the same year as his grandfather Robert died, and also Robert Louis Stevenson came into the world for Thomas and his wife Maggie at 8 Howard Place. They all passed each other like 'ships in the night' in that eventful year marking the mid-century. Robert James was known to Louis and everyone else as 'Bo'. [54,55] He was Louis' first friend and playmate. The two little boys saw so much of each other because 'Cummy', Louis' nursemaid, walked the short distance from 1 Inverleith Terrace. They moved there when Louis was two. She could enjoy the company of Catherine Docherty, 'Cashie', who was nursemaid to the Davids, as Louis always called them. There also was Agnes Wilson, 'Aggie', semi-retired after a lifetime of service to the

earlier generation in Baxter Place. The three women consumed a comforting cup of tea together and enjoyed talking in the 'Lallans', the Lowland Scots tongue that was not always comprehensible to the children. Stories of Louis' very lonely childhood have been much exaggerated. Elizabeth Stevenson [56], with six growing children, was very close to the beautiful young Maggie, newly married to Thomas, and she helped her in every way she could. Their two husbands met daily in the firm's office at 84 George Street so family news passed quickly between them.

In Maggie's famous diary are the following entries:

'January 1853. 22nd Saturday. Smout at his first party at Forth Street. He was very good and shouted with delight when he saw the magic lantern.'⁴⁸

Next morning, on Sunday the 23rd, Smout's first words were:

'Did Uncle David show it to me?'

Tragically she made this entry on April 24th, 1854:

'David's wee boy Bobbie died to-day of intermittent fever ending in water in the head. Smout did not like to hear of it and said he 'hoped it would please God never to let him die'. He asked if Bo would be playing in heaven. Tom came home to-day for the funeral quite unexpectedly. (In Colinton.)'⁴⁹

Elizabeth was by then six months pregnant. Three months on Maggie records:

'21st July 1854 Friday. David's second son born ... David Alan.'⁵⁰

Maggie does not record the birth of a third son, Charles Alexander, in 1855.

David was always deeply religious and was an elder of the Greenside church where all the family worshipped. It was 200 yards from their home at 25 Royal Terrace. He was also a Secretary of the Scripture Readers Association and he wrote several small books that were published for his mission work and intended to 'direct the young to the Bible in the matter of our salvation'. He was a member of the same photographic society as David Octavius Hill and Robert Adamson. He was working in the days when there were no dry plates, no films or hand-held cameras and he was producing 'positives' before 1855. He sensitised his plates and developed them in the harness room adjoining the stables. The cap on the outside of the lens was taken off by hand and replaced by hand when the time exposure, about 4 seconds, was considered sufficient. The positives were as a rule beautifully clear and most have lasted unfaded for years.

David Stevenson died at North Berwick on the 17th of July 1886. He was the only one of Robert's children who chose a new grave site in the Dean Cemetery, on the west side of the town, probably because he knew his family were too numerous for the 'gated cell'. This letter was from R.L.S. to his parents:

'19th. July 1886.

My dear people,

This is a scratch to say my cold is better and to mention that I have heard of poor Uncle David. I don't know why I should say poor; he was won off the stage, and has been waiting his exit for some time. I fear my father will fear it; but these things are rewards to those who go; good wages I am sure. It seems difficult to think of the world without Uncle David.

Your aff[ectionate] son
R.L.S.³⁰

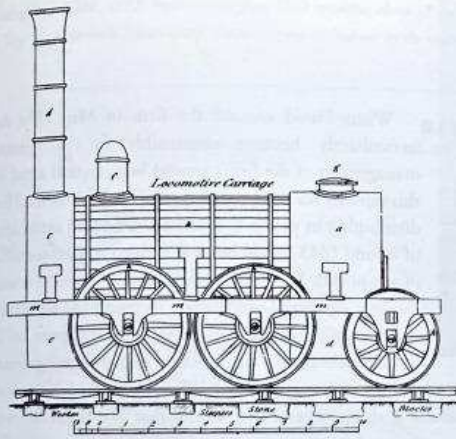
Maggie Stevenson replied on 31st July:

'Uncle David's death upset your father very much ... He was very low for a day or two (quite done and never to be fit for anything again) but he is a shade better to-day'.³¹

A professional aspect

David, unlike his brothers, was single-minded about pursuing an engineering career from his early teens, and was a mature nineteen year-old when he went south to gain experience of railway work with national contractor William Mackenzie (1794-1851). He kept a memorandum book of engineering data which he updated throughout his life-time, illustrated diaries and other accounts, which make fascinating reading today. For example, during the building of Edge Hill tunnel on the Liverpool & Manchester Railway in 1834, he:

... spent many a weary hour and I may say night, for Mackenzie, with whom I lived for some time, would often after finishing his pipe and glass of brandy and water, instead of going to bed, go out to one of the shafts which as ill luck would have it was close to his house and if he found by further bad luck a bucket going down he would at once say "now then Stevenson let us just jump in and see what these fellows are about down below" and I knew that on all such subterranean excursions the night was sacrificed and instead of sleeping quietly in bed there was in store a journey through dampness and darkness in a suffocating stench of gunpowder and workmen part of the way being through long narrow holes called drifts in which we had to crawl on hands & knees and the whole nights expedition terminating in making our



[57] Liverpool & Manchester Railway locomotive. From David's paper in *Arcana of Science and Art*, 1836.

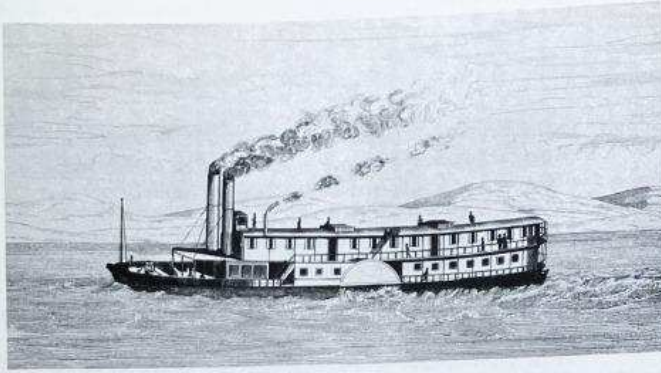
exit into daylight at 4 or 5 in the morning at the Hay Market (exactly opposite the spot where St. George's Hall now stands) in a state of dirt . . . I got into the way of making myself scarce when I saw a chance of a midnight visit to the works.⁴⁶

In his diary covering this period a wealth of detail is recorded. The tunnel, was for a double-track railway with an inclination of 1 in 96, and was 2240 yds in length, 25 ft broad and 20 ft high. It was excavated with vertical sides through soft red sandstone and a segmental arched roof was formed, one to two and a half courses thick, springing from skewbacks formed in the rock [sketch]. The void above was firmly packed with stone slivers . . . they work at 4 faces and excavate at the rate of 22 yds per month at each face working with a day and a night set of men, all the rock is blasted and the work is done by candle light. The blasting powder costs 6d. per lb and priming powder 8d. The workmen are kept strait by wires hung from the centre of the roof to

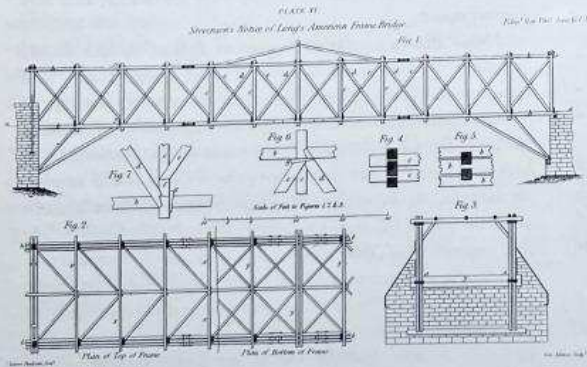
which they attach candles, the process of levelling likewise is performed by attaching a candle to the vane of the levelling rod. There are 3 or 4 shafts by which they bring the excavated rock to surface.⁴⁷

In November 1835, on completion of his apprenticeship [Appendix 3], David obtained the post of resident engineer at Granton Harbour, Edinburgh, for the construction of a pier and approach road [Granton Road]. [44] In accepting this position he had declined an invitation from Marc Isambard Brunel (1769-1849) to work as a resident engineer on the Thames Tunnel, which became one of the wonders of Victorian London and now forms part of London Underground. He described Brunel, whom he met at the tunnel soon afterwards, as a very fine old man.⁴⁸

About this time David began to follow in the family tradition of communicating with learned societies and read papers to the Royal Scottish Society of Arts on two railways of which he had first-hand knowledge, the *Liverpool & Manchester* [57] and *Dublin & Kingstown*. His paper on the former earned him an honorary silver medal from the Society, as did another on the building materials of the United States six years later. In 1838 his influential and now historically valuable *Sketch of the civil engineering of North America*, encouraged the introduction into Britain of faster streamlined steam vessels with long-stroke pillar engines and, the adoption more generally, particularly in developing countries, of cost effective timber structures, including bridges. [58,59] David, no doubt encouraged by Robert, was responsible for designs prepared by the firm for an 8-span *Town* type truss crossing of the River Tweed at Norham (1838), not executed, and a 150ft. span Long's frame bridge for India.



[58] Western Water steam-boat on r. Ohio, 1837. From David's drawing in his *Sketch of the Civil Engineering of North America*, 1838.



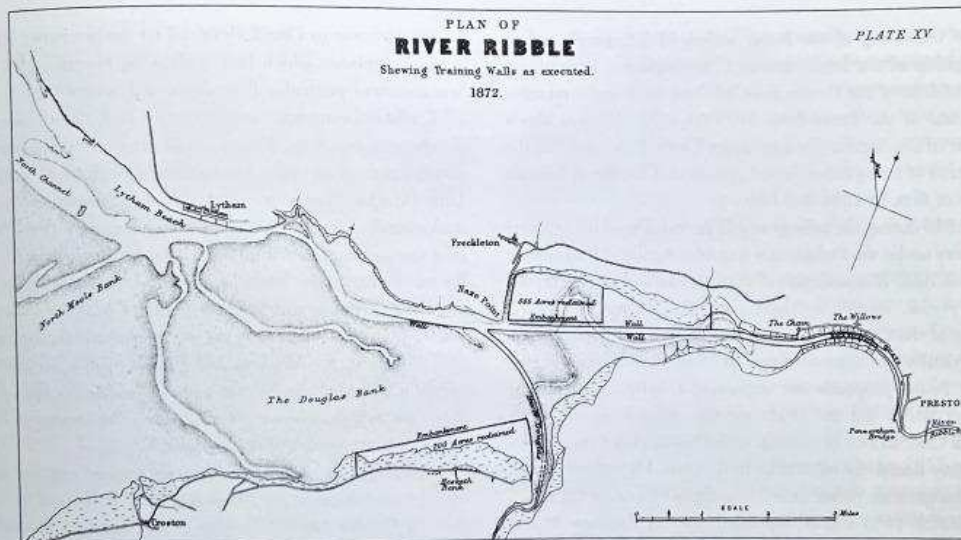
[59] Long's American timber frame bridge, 1838. Widely promoted by David as an economical and effective bridging method for developing countries. From his *Sketch of the Civil Engineering of North America*, 1838.

When David entered the firm in May 1838 he immediately became responsible for the entire management of the firm's general business and acted in this capacity for the next 43 years. The firm's method for distributing its profits is of interest. Under an agreement of 8 June 1843 David became entitled to four-sevenths of any profits. From 1849 when he and Thomas became the only partners David's share increased to two-thirds, becoming three-fifths from 1854, and a half from 1872.

⁵³ In Scotland the firm's work included navigational improvements on the rivers Forth, Tay, Clyde, and Nith, and numerous harbour schemes of which that for Peterhead was among the most notable. English projects included improvements to the rivers Dee, Lune, Ribble [60], Wear and Fossdyke and, in Ireland, the Erne and Foyle. Other work included Mullagmore and Morecambe harbours, Allanton bridge, Newfoundland lighthouses, Peebles railway, Birkenhead docks and opposing proposed railway crossings of the rivers Tay and Dee for navigational interests.

David soon developed an expertise in river engineering. In 1842, arising out of his practice in connection with the Dornoch Firth salmon fishings and Tay navigation, he defined the different lengths of a river according to its characteristics by what were to become the universally-known terms, 'sea proper', 'tidal', or 'river proper'. This work led to his paper 'Remarks on the improvement of tidal rivers' read to the Royal Society of Edinburgh in 1845, in which he argued conclusively that if the duration of tidal influence was extended, the hydraulic head would be lessened and the velocity of tidal currents decreased. He

Plan of River Ribble, 1872. Improvements from 1839 involving about 18 miles of rubble training wall in the river bed, lowered the low water level more than 7 ft. allowing larger vessels to reach Preston quays. Deepening was carried out by the steam bucket dredger Robert Stevenson to the firm's specification & launched in January 1839.



recommended appropriate measures to achieve this end. He also correctly propounded the theory of the origin of bars at the mouths of rivers and defined effective measures for their removal. In estuaries, where appropriate, he advocated the channelisation of currents between low rubble training walls, a practice which was subsequently adopted extensively.[60]

In order to encourage the collection of accurate data upon which to found river and maritime improvements, David published in 1842, *A treatise on the application of marine surveying and hydrometry to the practice of civil engineering*, which described the manner of conducting the survey of a river or

harbour from beginning to end. [61] This useful work, the first of its kind, attracted excellent reviews in the technical press and, three years later was followed up with his *Remarks on the improvement of tidal rivers*, which developed into an *Encyclopedia Britannica* article and the standard reference source *Canal and river engineering*, 1858. *The Builder* considered this work, which reached a third edition in 1886 and continued in use well into the present century, *second to none* in its field.

All these and numerous other publications added to David's reputation and helped to establish him as an international authority in this branch of engineering. In 1844 he was elected

both to fellowship of the Royal Society of Edinburgh and to membership of the Institution of Civil Engineers, becoming a vice-president of the former from 1873 to 1876 and a member of council of the latter from 1877 to 1883. He was also a member of the Société des Ingénieurs Civils, Paris, and had the distinction of being twice elected president of the Royal Scottish Society of Arts, in 1854 and 1869.

In 1846 during the railway mania period, David held Courts of Inquiry under the Preliminary Inquiries Act for at least twenty proposed Bills. It is understood that his findings were accepted in every case, except for the Caledonian Railway's proposed crossing of the Clyde at Glasgow which was at first opposed by the Admiralty but approved later. In 1849-1850 he reported on Fishery Board proposals for improving Lybster and Scallisaig harbours which led in 1851, on the retirement of Joseph Mitchell C.E., to him becoming, with Thomas, joint engineer to the Fishery Board for more than thirty years. He insisted on the joint arrangement, rather than a sole appointment for himself.

In March 1853 David succeeded Alan as Engineer to the Northern Lighthouse Board, after failing to persuade the Board to allow him to serve jointly with Thomas, an arrangement which he considered essential in order to safeguard the firm's private business on which its financial success mainly depended. David eventually prevailed in this, although not without considerable opposition. In March 1855 he resigned his individual appointment and *D. & T. Stevenson* took on the role as the Board's Engineers until David's retiral in 1884 after several years of ill-health. At the same time the responsibilities previously attached to the post for the general management of the whole service including lightkeepers and stores, which had

become *irksome* to David, devolved on the Secretary.⁶⁴ Of the many lighthouses which they built, Dhu Heartach 1872 [62] was a work of particular difficulty, as will be seen later.

David's competent management and dedication were nowhere more ably demonstrated than in the temporary construction of Britain's most northerly lighthouse at North Unst (Muckle Flugga) in 1854, and its successful completion undoubtedly helped him to prevail in his tussle with the Board over the joint engineership issue. This had been preoccupying his mind when, as he wrote later, *the Russian war broke out & a blockading fleet was sent to the White sea. The Admiralty was of course, I suppose, consulted by the government and as there was no light to indicate the Northern and Eastern coasts of the Shetland islands it seemed desirable that when the blockading fleet left the White sea they should have something more than Sumburgh Head to tell them the position of the Shetland.*

Accordingly the Admiralty hurriedly resolved that two lights should be exhibited on the North East coast of Shetland not later than 1st October 1854. I therefore at once sailed for Shetland on 17th February of that year to determine which were the most useful sites and what was the best method of carrying out the instructions of the Government. The weather was wretched and the passage most uncomfortable and on arriving at Lerwick on Saturday night at 11 o'clock, having experienced considerable difficulty in finding the entrance to the Bay we were informed that the last mail received at Shetland from the mainland was on 1st December [1853] and that the winter had been an unusually severe one. There were no steamers trading there at that time and the poor Shetlanders who had been nearly three months without communication received our printed and verbal "news" with the greatest interest . . .

North Unst [was one of the sites selected for a light] . . . the other being Whalsey . . . our appearance off the coast at that season of the year caused no small speculation among the simple islanders. The rumour of the war too it seems had reached them . . . they all retreated to the interior leaving their houses to our mercy and we learned afterwards that they were afraid of the press gang or that we might be Russians.

When surveying the several sites on which we landed I had a very favourable opportunity of witnessing the effects of the storms during the recent severe winter which had left their traces in unmistakeable distinctness on every headland . . . they were particularly observable at North Unst where the deep water comes close to the rocks also at Lambaness and Balta where stones of half a ton were thrown up on the green sward at elevations of 80 to 85 feet above high water and I came to the conclusion that what I had formerly considered as abnormal seas occurring at certain peculiar places such as Whalsey were in point of fact normal in this country being common to the whole of the North and East coast of Shetland and indeed in all other places where similar physical circumstances prevail there being deep water close in, and the exposure being open in all directions affording in fact a corrolation of my observations made on the waves of the American Lakes and their causes - area of exposure and depth. I reported that no buildings could be considered safe on any part of that coast which were not very considerably elevated above high water level . . .

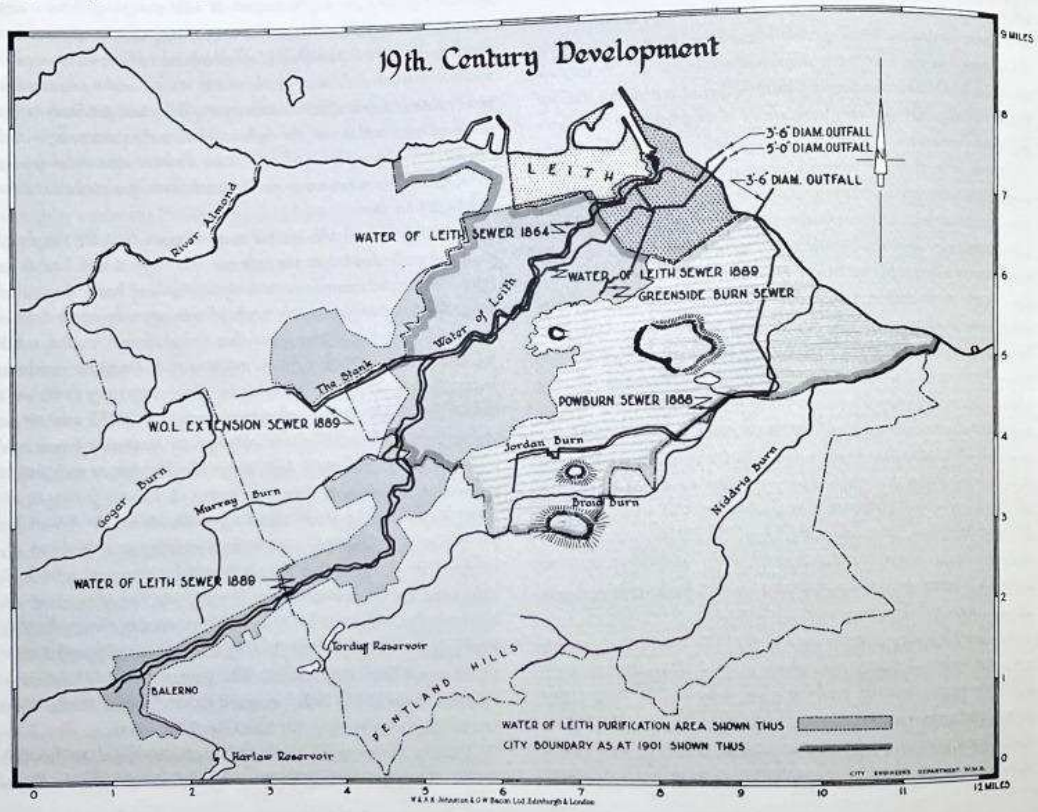
On my return from this voyage no time was lost in getting ready apparatus and preparing temporary wooden towers for the lights and iron houses for the Light Keepers, which were erected and surrounded with rubble walls for warmth. These had all to be made and fitted up in Edinburgh - vessels had to be hired to convey them, and all arrangements had to be made for their erection at the

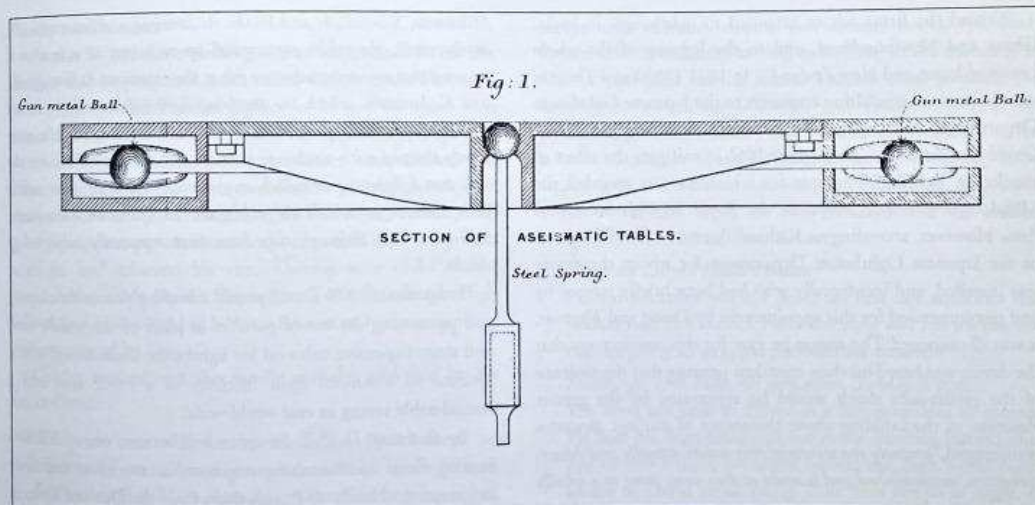
place, for getting the Light Keepers to take charge of them - and many other needful requirements not excepting supplies of provisions for the winter the responsibility of all devolving entirely on me and to make matters worse I was by no means well . . . the preparations went on and by dint of perseverance every thing was got ready before the fleet required to use the lights. Whalsey temporary light was exhibited in September and Mr. Alan Brebner who acted as my assistant at Unst managed to get the work done in a very short time [by 11th October] . . .

With reference to this work I may mention that the weight of materials to be landed at the rock was 120 tons which had to be sometimes hauled through the surf, that everything had to be carried up a rock 200 feet high on the backs of men, there being no time to prepare any other appliance - and that the whole was landed, taken up, and built, in 26 days on an outlying rock the most northern habitable spot in the British Islands. These temporary works were visited during the winter after their erection in 1855 with severe storms from the North West and although the temporary houses and tower were 200 feet above high water the seas rose to such height and in such weight as to deluge the houses with water forcing in the doors and throwing down the walls built round the houses for protection . . . abnormal sea storms depending as they do on the conjunction of high winds from a particular direction, with high tides, and a long continuance of the gale, do not often occur, an interval of apparent rest being merifully granted to those, who, like myself have all my life been fighting with the sea although I must admit not always successfully.⁶³ The permanent lighthouse was completed in 1857. [63] A good example of a minor light erected in the same year was Kyleakin, Skye. [64]

During the next 25 years the firm continued to flourish under David's management. When in 1858 a Royal

[65] *Edinburgh Main Drainage in 19th century. The Stevensons were the consulting engineers for the Water of Leith sewers of 1864 and 1889.*





[66] Azeismatic table for mitigating earthquake effects on lamps in Japanese lighthouses. The circular table which rested on 3 balls in cups (2 visible), bore an array of holophotal reflectors. The steel spring added to restrain unrequited motion was only partly successful.

Commission was appointed to inquire into the condition of the lights, buoys and beacons of the United Kingdom, J.T. Chance commented that the lights of England and Ireland were *much inferior to those of Scotland which were under the able supervision of the Stevensons.*⁵⁴ With the passage of time Thomas also made an increasing contribution to the firm's success which is reflected in the incidence of his published reports and in 1872 David implemented an equal division of the profits between them.

During their 27-year partnership the two brothers are understood to have divided the sum of £95,000 in fees, after payment of salaries and expenses, of which about one-quarter came from the Northern Lighthouse Board.⁵⁵ In addition to maritime work, public health improvements were undertaken, including Edinburgh & Leith sewerage, the city's first such major scheme involving construction of the Water of Leith sewers of 1864 and 1889 to outfalls in the Forth. [65]

Abroad the firm's advice extended to lighthouses in India, China and Newfoundland, and to the lighting of the whole coasts of Japan and New Zealand. In 1871 David and Thomas were appointed consulting engineers to the Japanese Lighthouse Department. For Japanese lighthouses in earthquake zones David devised an *aseismic joint* [66] to mitigate the effect of shocks on lighting apparatus for which he was awarded the Makdougall-Brisbane Medal of the Royal Scottish Society of Arts. However, according to Richard Brunton, Chief Engineer of the Japanese Lighthouse Department for whom the device was installed, and incidentally who had been briefly trained by and recommended for this appointment by David and Thomas, it was *ill-conceived*. The reason he gave for this opinion was that the device was based on their mistaken premise that the violence of the earthquake shock would be aggravated by the greater elevation of the building above the source of motion. Brunton commented, *precisely the reverse of this occurs actually and Messrs Stevenson, accomplished and learned as they were, came to a wholly erroneous conclusion.*³⁵

The aseismic joint was installed at only seven lighthouses. It was fitted to 8 ft. diameter tables and, although mitigating the effects of external movement, the unrequited motion which occurred during lamp cleaning and wick trimming deranged the lamps. David devised a steadying arrangement but this was only partly successful. In defence of a charge that the device had been found wanting and abandoned, Charles wrote in 1884, *there are three at present in action, and have been so for ten years, viz.*

*Mikomoto, Siwoomisaki and Yesaki. At Twosima and Satanomisaki, in the south, the tables are screwed up so as not to act, as it is reported that no earthquakes are felt at these stations. At Tsuragisaki and Kashmosaki, which are revolving lights, the steadying screws sent out with the apparatus were not put in and the tables were firmly strutted with timber to prevent any motion. These are the only two lighthouses at which any damage has been done; while those stations at which the tables are in operation have never suffered at all, although they have been repeatedly subjected to shocks.*³⁶

From about 1870 David played a leading part in developing and promoting the use of paraffin in place of the widely used and more expensive colza oil for lighthouse illumination which resulted in enhanced light intensity at a lower cost and a considerable saving in cost world-wide.

By this time *D. & T. Stevenson* had become one of Britain's leading firms of consulting engineers in maritime and river engineering. Nearly all British rivers from the Dee and Trent to as far north as Donoch Firth, and many harbours, had come under its remit, including Wick breakwater, their notable failure, which will be referred to in more detail later.

David's substantial contribution to his profession and mankind through his outstanding engineering practice and in consolidating and ensuring the continuance of the firm, ranks second to none in the achievements of the Stevenson family of engineers.

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