

1992



SMEATON LECTURE 1992

ON THE HISTORY OF CIVIL ENGINEERING



SMEATON IN SCOTLAND

by

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Chairman, Panel for Historical Engineering Works

on

TUESDAY 14 JULY 1992 at 6.30pm

at the

INSTITUTION OF CIVIL ENGINEERS

TEA AVAILABLE FROM 6.00pm

Smeaton's wide-ranging power and communications improvements were fundamental to the development of Scotland. Some also played an important role in his 'fathering' of British civil engineering. The lecture will highlight Smeaton's achievement and its significance in terms of engineering development and conservation.

An exhibition to celebrate Smeaton's life and works will be mounted at the Institution from 6 July to the 28 August 1992

An accompaniment to a lecture,
SMEATON IN SCOTLAND,
given by Roland Paxton, MSc, CEng, FICE,
at the Institution of Civil Engineers, London,
on 14th July 1992.

'Of Mr Smeaton's intellectual powers it would be difficult to speak too highly. James Watt always mentioned him in terms of sincere admiration, speaking of him as "father Smeaton" ... "his example and precepts have made us all engineers" ... In 1858 Robert Stephenson observed to the author "Smeaton is the greatest philosopher in our profession this country has yet produced."'

Dr Samuel Smiles, 1861.

John Smeaton, F.R.S. (1724-1792) deserves to be remembered not only as the 'father' of civil engineering but also for the immense contribution his harbour, bridge, power source, river improvement and canal projects made to national development and the well-being of society. These projects provided many thousands of jobs during construction and great benefits to the promoters and community at large on completion. In Scotland alone, which occupied some 25-40% of Smeaton's prodigious work output, more than fifty of his schemes have been identified, of which most were carried out and at least ten still give useful service after two centuries. Scotland is fortunate to possess both the greatest canal and largest bridge engineered by Smeaton—the Forth & Clyde Ship Canal and Perth Bridge—as an historic buildings legacy of exceptional significance. The recording of these and other works and encouraging the conservation of fine examples form an important part of the work of the Institution's Panel for Historical Engineering Works.

In professional terms Smeaton is believed to have been the first to designate himself 'Civil Engineer' and did so in an engineering report of 1754 proposing the drainage of Lochar Moss near Dumfries. He used this title only occasionally in reports, generally adopting simply 'Engineer', the 'civil' as distinct from 'military' presumably being implied from the type of work. The influence of Smeaton's work on his contemporaries and succeeding generations of engineers was fundamental. It emanated largely from direct contact and his Eddystone Lighthouse folio of 1791 which was much consulted for the design and building of the Bell Rock Lighthouse and other works, and which provided valuable data on hydraulic cements. His *Works* published in 1797, 1812-14, and reprinted in 1837, were also widely consulted.

The following two previously unpublished Forth & Clyde Canal letters were from Smeaton to Alexander Hart, Agent to the Proprietors of the Canal, Parliament Close, Edinburgh. The first letter illustrates his painstaking arrangements for plan distribution from a distance. Robert Mackell (d. 1779), to whom reference is made, was the Resident Engineer (another title introduced by Smeaton), probably the first man to be so named. The second letter is indicative of the degree of autonomy allowed by Smeaton to Mackell in determining the as-built form of the forty or more aqueducts and tunnels, although he did provide specific plans for the major aqueducts at Kirkintilloch and Camelon.

Austhorpe 7th. Feb 1769

Dear Sir

I duly received your favour of the 30th Decr. with the contents inclosed: for which I give you thanks. This comes principally to acquaint you that the lock plans are now upon their journey to Edinburgh, but being much more bulky than I expected, when I mentioned sending them by the post, and even when made up the short way which our worthy friend Mr. Kerr recommended, are near upon two feet in length; having also two setts to send, which in the whole take up a considerable bulk, I determined to send them as follows: they went yesterday by the London fly to Newcastle, where I expect they will arrive this evening: They are putt up all together in a box directed "To Mr. Alexr. Hart, Secretary to the Proprietors of the Forth and Clyde Navigation at Parliament Close, Edinburgh - To the care of Mr. Scott opposite the Printing Office in Pilgrim Street, Newcastle." I wrote Mr. Scott yesterday desiring him on the receipt thereof to leave a card at the 3 principal inns there; purporting that Mr. Smeaton being desirous of sending some plans to Edinburgh for the Forth & Clyde Navigation in the most expeditious manner, if any person going by postchaise to Edinburgh will take the care of delivering them as directed, any reasonable gratuity will be made which they shall desire. - But in case nothing of this kind offers before the 1st carryer departs from Newcastle, for Edinburgh, to send them with him; & which ever way they go, Mr. Scott is desired to write to you to advise you of their departure, by whom sent, & when expected at Edinburgh: so that I hope you will receive them safe, and without much delay. They dont come quite so soon as I expected when I wrote you last; but when you see the parcill I believe you will do me the credit to suppose that neither I, nor my office have been idle; it having indeed been the whole employ thereof, ever since I got home, after that journey from which I sent my review: that is ever since the 10th. Novr. There has been in fact 3 setts made out; one for Mr. Mackell; whereby the works are to be directed; another sett I propose to lodge with you, to be occasionally referred to by the Committee, myself, & Mr. Mackell; without the necessity of carrying them backward & forward, which wear them out; and a third sett for my own use, to referr to at home, in giving future orders: and in order that the sett of designs that I lodge in your hands may be compleat from the beginning, I have also sent duplicates of all the drawings & descriptions thereof, that have heretofore been transmitted to Mr. Mackell.

The present parcill therefore contains - a roll marked N 1 which contains the duplicates of the designs & descriptions heretofore sent to & lodged with Mr. Mackell. N 2 contains a sett of lock plans whose description accompany this letter, which when you receive, you are to putt up together. The description not being able to be got ready to go along with the parcill to which it belongs. Both these rolls to remain with you. N 3 contains a sett of lock plans the same as N 2 and are for the use of Mr. Mackell, for directing the works - the description being inclosed therein, which is a duplicate of what you now receive. You may therefore send them to him without disturbing them.

I hope you will receive them all safe & in good condition; and I request of you that no copsy thereof may be taken, without my knowledge & consent, except such notes & memorandums as may be necessary for those actually concerned in the direction or execution of the work.

You will be pleased to present my compliments to Mr. Kerr and thank him for inclosing the printed copy of Mr. Golboms proposals concerning the Clyde, which I duly received; which as they dont concern my scheme, will rest in peace.

I am desired to attend the London Meeting of the 15th. inst. and shall sett out on Saturday next. I expect to be away about 3 weeks and while in London please to direct to me at Mr. Holmes, Watchmaker near Somerset House, London.

I write to Mr. Gwyn this post to advertise him that the plans will be both in your, and Mr. Mackells hands, in a few days so that when you receive them you will be pleased to drop him a line to Perth.

I also write to Mr. Mackell & I am Dear Sir

Your most humble Servt.

J. Smeaton.

I need not say that no time should now be lost in settling the contracts for the execution of the locks. [FPA S/4]

Another letter, dated 29th November, explains that, for the aqueducts,

I have all along endeavoured to adapt my several designs to the general purposes to which they were intended ... and as therefore the resident engineer has approved himself to me and I trust in like manner to the Committee as a man of judgment, diligence and ingenuity in the application of materials put into his hands, I did not think of sending him any more plans for aqueducts ... I apprehend that he sets them out upon the ground without a plan ... [SRO: BR/FCN/1/2]

Extracts of a letter from Smeaton to Hervey Redmond Morres, 2nd Viscount Mountmorres (c. 1746-1797), dated Austhorpe, 12.12.1772, giving management advice at the outset of the Grand Canal project in Ireland, based on his five years intensive experience on the Forth and Clyde Canal and other work. Printed in full in *Letters between Redmond Morres ... and John Smeaton ...* Dublin, 1773. [Trinity Coll. Lib., Dublin.]

In August 1829, Charles Landale (1764?-1834), Engineer to the Dundee & Newtyle Railway, then under construction, reprinted at Dundee these *Excerpts from Letters of the Celebrated Smeaton relative to the Duties of Committees and Engineers on Public Works*, freely edited, in a *Letter to the Railway Committee* defending himself from adverse criticism on his management of the project which was overspent. Smeaton's advice was still proving useful in Scotland more than fifty years after it had been first given, and much of it will be readily recognised by the reader as still valid!

... Your four Committees seem very properly chosen for Direction, Superintendency, Accounts and Controul, but the great difficulty is to keep Committees from doing either too little, or too much; too little when any case of difficulty starts, and too much where there is none. It happens to be the necessary connection of all those matters, that the supreme Direction is in a number of Gentlemen, who cannot be supposed to be adequate Judges of the merit of what is mechanically performed; were the construction of a watch the subject of direction, it is probable that not one Gentleman in the whole Committee can make a watch: The necessity of the thing therefore would oblige them to employ a Watchmaker, to him they must in a great measure trust; in *fact*, he must as to *mechanical*

construction direct the Directors; as to all other matters, I suppose the Committees will be competent judges. The greatest difficulty of all therefore, is to get a proper person for the Resident Engineer, Practical Knowledge in Mechanics is not the only thing wanted to equip a man fully[,] for this employment requires so great a number of qualifications that I look upon it as impracticable to find them united in one person. I therefore take it for granted, that he will of course be capitally defective in something, and as such there is the greatest difficulty in the world, to preserve a good understanding between the Resident Engineer, and the Committee that directs him, and yet he is of all others the most difficult to be parted with when this happens. I observe that the Resident Engineer is always the Post of Envy; not only the Clerk, the Store-keeper, the Surveyor, the Digger, are ready to neglect their own departments, and are all ambitious to be practical Engineers; sometimes without knowing or thinking that they are so; but even Members of the Committee have a propensity this way too; ... by this means, all becoming Masters, and the Master without authority, it is easy to figure the confusion that must follow. ...

The office of Resident Engineer, naturally creates *many attentions*; ... Let all the subordinate Parts have a particular Officer assigned to them, in order to relieve the attention of the Engineer ... A Purveyor, ... A Land Surveyor to measure the Lands staked out, or proposed for purchase, temporary Drainages, &c. to measure the Work of the Artificers done by contract, &c. and to take Levels occasionally ... A Land Valuer ... A Pay Clerk ... A Clerk ... A Store-keeper, ...

... One of the greatest things that Committees can do, is to keep a watchful eye over their Officers, to see that they are employed in their own departments, and in their own departments *only*; it is a common thing for persons who are conscious of no superior merit in their own department, to endeavour to make a merit, and make themselves of consequence, by remarking upon the failures and defects of their superiors. ... I take it for granted that none but a paltry insinuating fellow, would be an informer of any kind; ... Stone, Wood and Iron, are wrought and put together by mechanical methods, but the greatest work is to keep right the *Animal* part of the Machinery; and I will be bound to say, that if the Committees can preserve a good Understanding between themselves, and their principal executive Officers, and prevent those from falling foul of one another, it will be a saving of a great many Thousand Pounds to this Undertaking, and of much disquiet to those who have the principal management: I have observed that many more defects arise from want of *will*, than from want of *skill*.

It now seems time for me to make an Apology for the freedom of my Expressions, upon the duty of the Committees, rather than of their Officers, ... I have not offered any thing, but what every sensible Man will practice in the management of his own affairs; and therefore that those cautions are altogether unnecessary; but here lays the very point, for though it seems impossible for any person to conduct himself *otherwise*; yet such is the fatality of bodies of Men, that all that I have been yet concerned with, have sooner or later fallen into those very obvious mistakes; and therefore if by setting up a Beacon which shall be a warning of danger, and by this means enable the Works to proceed with concord for a greater length of time, I shall think I have done your Undertaking a material piece of service: ...

'John Smeaton was the earliest of the great British civil engineers and the first to achieve distinction as an engineering scientist. It is also to him, more than any other person that credit is due for laying the foundations of the civil engineering profession in this country ...' Prof. A. W. Skempton, 1981.