Biographical Dictionary of Civil Engineers in Great Britain and Ireland

Volume 2: 1830–1890

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Preface

In 1995 the Archives Panel of the Institution of Civil Engineers began to investigate the practicability of compiling a biographical dictionary of civil engineers. Such a work was seen as answering a need within the profession and filling a gap in the published history of Great Britain and Ireland. Biographical works dealing with related professions are well established with Sir Howard Colvin's *Biographical Dictionary of British Architects, 1600–1840* (3rd edn., 1995) and Sarah Bendall's *Dictionary of Land Surveyors of Great Britain and Ireland 1530–1850* (1997) developed from the earlier work edited by Peter Eden (1975–1979).

The Council of the Institution agreed to support the enterprise. An Editorial Board, reporting to the Archives Panel, was appointed in May 1996 consisting of

Chairman:	Professor Sir Alec Skempton, Imperial College
Secretary:	Mr. M. M. Chrimes, Head Librarian, Institution of Civil Engineers
Members:	Dr. Ron Cox, Trinity College, Dublin; Mr. P. S. M. Cross-Rudkin, Coventry University; Dr. R. W. Rennison, Newcastle upon Tyne; Mr. Ted Ruddock, MBE, Edinburgh.

From the outset it was realised that more than one volume would be necessary, owing to the large number of entries and the desirability of describing works before the mid-eighteenth century in some detail, since such information, with few exceptions, is not readily available elsewhere. Volume 1, published in 2002, contained biographies of men engaged in civil engineering in Great Britain and Ireland between 1500 and 1830. Engineers of British birth working overseas were included.

The years around 1830 provide a convenient division between the classic period represented by Smeaton, Brindley, Jessop, Rennie and Telford, and a new era: the railway age, dominated initially by Robert Stephenson, I. K. Brunel and Joseph Locke. It was also the time when contractors such as Thomas Brassey, with the ability to finance and undertake works costing millions of pounds, at home and abroad, began to play a more prominent role. The expansion of Empire created new opportunities for significant numbers of civil engineers, both in London-based consultancies and more especially on the ground.

Sadly, Sir Alec Skempton died shortly before publication of Volume 1. For Volume 2, the chairmanship of the Editorial Board passed to Mr. P. S. M. Cross-Rudkin. Mr. M. M. Chrimes, now Head of Knowledge Transfer at the Institution of Civil Engineers, continues as Secretary to the Board. All of the other members remain, with the addition of the following:

Mr. Lawrance Hurst, London; Dr. Robert C. McWilliam, Reading; Mr. James Sutherland, London; Mr. Tom Swailes, University of Manchester

Acknowledgement is made to the contributors whose names are appended to the articles they have written. Stephen Nixey gave valuable service as production editor.

Claire Delgal and Carol Morgan assisted in archival research, and Paul Parkes provided valuable administrative support.

Works covered in this volume of the Dictionary are principally: railways, harbours and lighthouses, docks, water supply and sewage disposal of towns, roads, and irrigation.

There were, of course, individuals active in the period who would not now be considered civil engineers but who were connected with the profession. There are, for example, architects responsible for structural innovations, military engineers involved with major construction projects, scientists, naval architects, academics involved in the provision of the first university degree courses in the discipline and authors of the early popular textbooks on the subject. A representative selection of such persons has naturally been included. Individuals who would now be considered to be purely mechanical engineers have generally not found a place in Volume 2.

Research is ongoing and the Editors would be pleased to receive additional information or material on new subjects. This can be forwarded to the Head of Knowledge Transfer at ICE for inclusion in supplements to the Dictionary, available in the Library and on the ICE website (http://www.ice.org.uk).

The practice of civil engineering 1830–1890

In Volume I of this Biographical Dictionary, Sir Alec Skempton described five periods in the evolution of civil engineering from 1500 to 1830. There were no such clear-cut divisions in the much shorter period covered by this second volume, so it is more relevant to look first at the changing organisation of the profession and then at the several types of work undertaken by civil engineers during the years 1830 to 1890.

Institution of Civil Engineers

The Institution of Civil Engineers (ICE) was formed in 1818 by five younger members of the profession, who were not senior enough to be invited to join the Smeatonian Society of Civil Engineers. From the beginning it saw itself as a learned society, rather than the social club that was the senior association. With Thomas *Telford as its President from 1820 it grew slowly, admitting only people sufficiently experienced to be able to contribute to the advancement of knowledge of the subject, but it had gained sufficient prestige by 1828 to receive a royal charter.

In 1830 there were over 150 members, classed as ordinary and corresponding, the latter category for those resident at a distance from London. In 1837 the two classes were merged, and new classes of graduates—associates and honorary members—were created. Graduates were required to be under training with recognised members of the profession but, as mentioned above, were expected also to be senior enough to contribute to professional knowledge. Few candidates satisfied both criteria and the class was extinguished in 1867, to be replaced by that of students, a recognition by then of the changing nature of qualification for practising the profession.

Of more significance throughout the period was the class of associates, who for much of the time comprised more than half the membership. This included contractors, but many associates could more accurately have been described as graduates, either of university or college courses or of a period of pupilage. The classes were revised again in December 1878 to create Associate Members, less senior than Members but, like them, with voting rights at meetings. This responsiveness to changing circumstances saw membership of the Institution reach 1,000 in 1862, over 2,000 in 1873 and nearly 6,000 by 1890.

Telford had been elected each year to the presidency of the Institution and James **Walker, who took over on Telford's death in 1834, continued the tradition. But a new generation of engineers was coming to the fore, and although Walker was a competent and generous President, there arose a feeling that the office should not be the preserve of one person. Robert **Stephenson, Joseph **Locke and George Parker **Bidder were three of the six unsuccessful candidates for Council in 1840 but when the matter came to a head in 1845 they were all too busy to undertake the duties and Sir John **Rennie was drafted in. By a liberal interpretation of the

rules he served for $2\frac{1}{2}$ terms; subsequent Presidents observed a two-year limit more scrupulously.

Robert Stephenson was elected a Vice-president in 1848 and went on to serve as President, as did Locke and Bidder, but railway engineers were by no means the only ones to reach the highest office the profession could bestow. James **Simpson was a leading practitioner in water supply, as were Thomas **Hawksley and John **Bateman. Sir Joseph **Bazalgette carried through a grand scheme for the main drainage of London. James **Rendel was a harbour engineer who also was involved in the progress of suspension bridge design and, like Stephenson, I. K. **Brunel and Locke, died in his fifties during the years 1856–1860.

Other institutions

The meetings at ICE throughout the period were remarkable for the wide variety of topics discussed. Nevertheless many members were not resident in London, and for them the facilities of the Institution were of little value. The Institution of Civil Engineers of Ireland was formed, as the Engineers Society of Ireland in 1835. Many members in manufacturing and railway operation were based in the Midlands and the north and a small group of such people met in Birmingham in 1846. They convened a meeting early the following year at which the Institution of Mechanical Engineers (IMechE) was founded. Although the first President of IMechE, George **Stephenson, was not a member of ICE, several other people would later hold office in both Institutions and ICE was quite relaxed about the formation of this new body. IMechE remained based in Birmingham until 1877. A further diversification occurred in 1860 when the Institution of Naval Architects was founded. As with IMechE, many members of this new organisation also retained their membership of ICE, but the Council of the latter body was moved not long after to note that ICE's charter made clear that the term 'civil engineer' embraced every branch of engineering except that devoted to the military art, and that 'this should be borne in mind when attempts are being made to split up into sections that which should ever be one united body'. Still, after the Society of Telegraph Engineers was founded in 1871, with (Sir) William **Siemens as its first President, it had free use of the ICE building in London for many years. It was renamed the Society of Telegraph Engineers and Electricians in 1883, and in 1888 became the Institution of Electrical Engineers (IEE). Sir William Thomson (later Lord Kelvin), the first President of IEE, was also a Vice-president of ICE. Despite the close relationship, ICE resisted the granting of a charter and it was not until 1921 that one was granted to IEE.

To cater for professionals for whom even these institutions were too remote, professionally or geographically, associations were formed from the 1850s such as the North of England Institute of Mining Engineers and the Institution of Engineers in Scotland, often publishing Transactions that could bear comparison with the ICE Minutes of Proceedings. The IES became the Institution of Engineers and Shipbuilders in Scotland in 1871, making the point that although engineering and shipbuilding might be seen separately, there was still enough common ground then to bring the two together in one body.

Overseas ICE developed strong relationships with similar bodies, often modelled on itself. British civil engineers were often active in the establishment of learned societies, particularly in the Empire.

Education and training

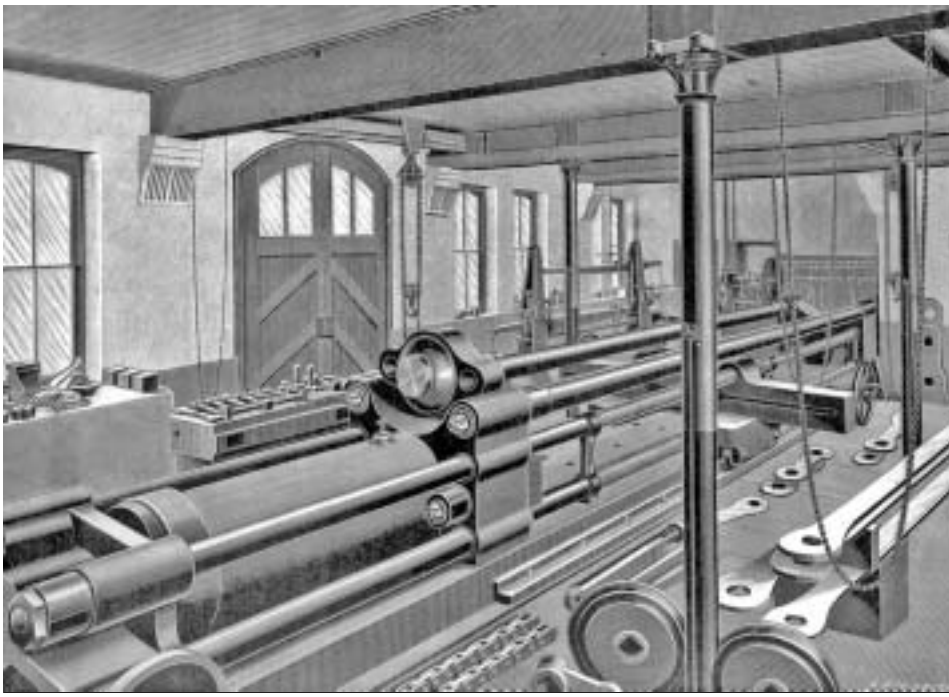
Before 1830 few civil engineers had the benefit of any sort of higher education, let alone in any subjects related to their vocation. Many of the leading men were quite scornful of the value of anything beyond ordinary schooling, holding that the only

Professors of The Royal Indian Engineering College

proper introduction was a training as a craftsman under the supervision of a practising engineer. This attitude, which evolved into a system of 'pupilage' that became a formal requirement for entry to ICE, persisted for much of the ensuing 60 years.

In 1830 there was anyway very little educational provision directly related to the profession. Charles *Hutton and Olinthus *Gregory, who between them occupied the post of professor of mathematics at the Royal Military Academy, Woolwich, from 1773 to 1838, wrote textbooks on mechanics that young engineers could use for a basic understanding. Henry **Moseley continued this tradition. The East India Company trained its personnel at its Addiscombe Seminary from 1809 to 1861, but entry to both Academy and Seminary was, by the nature of the establishment, seriously limited. Lewis **Gordon was appointed regius professor of civil engineering and mathematics at Glasgow in 1840 and Charles **Vignoles professor at University College, London, in the following year. King's College, London, the Royal School of Mines, the Royal School of Naval Architecture, the University of Edinburgh, Trinity College, Dublin, the Royal College of Science, Dublin, Queen's College, Cork, Queen's College, Belfast, Owen's College, Manchester, and Durham University offered relevant courses, though not all were long-lasting as enrolments in some cases were quite low. The Royal Indian Engineering College at Cooper's Hill was open from 1872 to 1906 and the private Putney College and Crystal Palace school operated for a time. If the memoirs of deceased members of ICE are any guide, perhaps one quarter of Members benefited from these courses.

Several Presidents of ICE in their inaugural addresses to the Institution touched on the subject of training, some dwelling at length on what was required. Sir John **Fowler rendered it down to three things—a fair knowledge of the most fitting material for any given work, under any given circumstances; the power of designing any ordinary work with a maximum of strength and a minimum of material or labour; and a knowledge of the means of ascertaining the cost price of any ordinary engineering work. Slowly there arose the recognition that colleges in the UK were not as good as those in France or Germany. A report commissioned by ICE and prepared by William **Pole in 1870 — *The Education and Status of Civil Engineers in the*



Kirkaldy testing works

United Kingdom and Foreign Countries — provided a wealth of data about the various systems of education, but failed to point a clear way forward. Because the continental systems were usually sponsored by government, which was anathema to many British civil engineers, there was resistance to their introduction in Britain. Those few engineers who did offer advice in the report seemed to favour a more formal system of technical instruction from the pupil-master. A constant theme here and elsewhere was the need for a liberal education, reflecting perhaps an unease about the social standing of the profession. As late as 1887, however, a President of ICE could declare 'We are constantly told that the difficulty Britain has in holding its own in the markets of the world is due to our want of technical education. There is something in this but, in my judgement, comparatively little. The true cause of the difficulty is the large increase in wages and the diminution in hours of labour'.

One reason why the lack of advanced analytical skills might not have been too great a hindrance was the use of model testing as a tool of design. Fairbairn's contributions to the design of the Britannia Bridge are well-known, but men such as William **Froude developed theory by experimentation. David **Kirkaldy created an establishment that was able to test full-scale items such as riveted joints, whose performance was just as important to the strength of a structure as the sizing of the main members.

Materials

The advances in engineering knowledge and practice that seem to have struck contemporary engineers most forcibly were those in metallurgy. In 1830 cast-iron arches were the choice for long span bridges, railways used lightweight wrought-iron rails, buildings were of traditional masonry construction and ships were built of timber. The increasing quantity and quality of wrought-iron, and then slowly