

APPENDICES

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APPENDIX 1

THE EARLY YEARS OF THE ICE¹

Encouraged by an expansion in trade and general prosperity within a period of political stability from about 1690, increasing numbers of construction-related projects provided sufficient opportunities for some of the leading practitioners of a discipline that would today be called 'engineering' to make a full time living. The projects themselves, though numerous, were relatively modest in scale. However, the unprecedented industrial and technological developments from the mid-eighteenth century that drove forward the 'Industrial Revolution' in Britain necessitated great improvements in the supporting infrastructure, which the technological revolution itself provided the means of achieving. From about 1760 there was a dramatic increase in the number of large projects involving docks and harbours, inland navigation, land drainage and reclamation, bridge construction and the like, which initiated a period of corresponding expansion within the profession that had evolved to meet the need. John Smeaton (1724-1792) is credited as being one of the first to describe himself as a 'civil engineer,' in 1763. The Society of Civil Engineers, founded in 1771 and later renamed the Smeatonian Society in his honour, was essentially a club for the leading professional engineers of the day.

Smeaton pioneered the systematic organisational hierarchy, quickly adopted universally, that was needed to manage the numerous projects for which he was Engineer, in a professional role that Angus Buchanan has characterised as a 'consultant mediating between a client and a contractor.' On each site he had a Resident Engineer as his permanent representative to superintend the day-to-day operations, supported by assistants, sub-assistants and inspectors. Buchanan has estimated the total number of potential professional personnel during the second half of the eighteenth century as about 260.²

The Institution of Civil Engineers was founded in 1818 in response to pressure for a more broadly based professional organisation, primarily as a learned society for younger engineers. In 1820 Thomas Telford, the most distinguished engineer of the day,

¹ This Appendix has drawn heavily on the following sources: Watson G., op.cit.; Buchanan R.A., The Engineers; Buchanan R.A., Brunel; BDCE1, pp.xvii-xviii, xxv-xxxiii; xix-xxxiv.

² Buchanan R.A., The Engineers, pp.38-44.

accepted an invitation to become the ICE's first President. In his inaugural speech he defined the standards of behaviour that were expected of members:

... it becomes incumbent on each individual member to feel that the very existence and prosperity of the institution depends in no small degree on his personal conduct and exertions; the merely mentioning the circumstances will, I am convinced, be sufficient to command the best efforts of the present and future members, always keeping in mind that talents and respectability are preferable to numbers.¹

He served actively as President until his death in 1834 and firmly rooted the ethos of 'gentlemanly' manners and behaviour among the membership.

At the time that Gravatt joined the ICE in 1826 four classes of ICE membership were defined. 'Ordinary Members' (denominated 'Members' from 1830) were those who were engaged in the practice of engineering. 'Corresponding Members' were those of the same description who resided outside London or who were otherwise unable to regularly attend ICE meetings. 'Associates' were persons 'whose pursuits constitute branches of Engineering, but who are not Engineers by profession.' 'Honorary Members' were eminent scientists who had written on subjects related to engineering. There were no formal examination or qualification requirements for entry. Angus Buchanan has described the 'club-like' entry procedure which was retained from the founding of the ICE right through to the late 1890s, whereby:

... membership was achieved by election amongst existing members on application proposals supported by sponsors and with some sort of demonstration of aptitude ... The emphasis was on practical experience, monitored by professional seniors, and improved by further practice in the light of discussion amongst peers.

Before 1826 the ICE purposely made no provision for pupils, apprentices and other 'young Persons studying the Profession,' as they were considered to make no contribution to the advancement of knowledge. An informal practice developed of proposing them as Associates, presumably as happened in Gravatt's case, but this was not formalised until 1830.

Following the grant of a Royal Charter in 1828 the Institution became, in line with the definition devised that year by Thomas Tredgold:

A Society for the general advancement of Mechanical Science, and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a Civil Engineer, being the art of directing the great sources of power in Nature for the use and convenience of man, as the means of production and of traffic in states

¹ Quoted in: Buchanan R.A., The Engineers, p.63.

both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks, for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and adaptation of machinery, and in the drainage of cities and towns.¹

That Gravatt's apprenticeship prepared him for a discipline that would probably nowadays be labelled 'mechanical engineering' rather than 'civil engineering' is therefore not surprising; the ICE's charter made clear that the term 'civil engineer' embraced all aspects of engineering except military engineering. It was not until the Institution of Mechanical Engineers was founded in 1847, initially to cater for professionals involved mainly in manufacturing and railway operations in the Midlands, that the engineering profession began to split into specialist disciplines.

Peter Cross-Rudkin and Mike Chrimes have noted that few aspiring civil engineers of that period would have had the combined educational and training benefits enjoyed by Brunel and Gravatt:

Before 1830 ... many of the leading men were quite scornful of the value of anything beyond ordinary schooling, holding that the only proper introduction was a training as a craftsman under the supervision of a practising engineer.

Over time a system of 'pupillage' evolved, based on the principles of apprenticeship, which later became a formal entry requirement for the ICE. As noted in Chapter 3, Gravatt took on young men under training arrangements that were described variously as 'articles' (Peter Margary, Charles Harcourt White and Richard Hassard) and 'apprenticeship' (William Cobbe), while some of his own assistants on the B&ER had been 'pupils' (William Froude) or 'apprentices' (John England and Charles Richardson) of other engineers, or merely 'trained' (William Peniston) by other engineers. By that time the terms appear to have been used arbitrarily to mean the same arrangement that was described by Angus Buchanan:

A young man would be employed, at his own or his parents' expense, and frequently on payment of a substantial fee, in the office of an established engineer, in which capacity he could be used to undertake field surveys, to make drawings, to negotiate contracts and land settlements, to supervise operations on behalf of his chief, and generally to participate in the activities which an engineer was called upon to perform.²

¹ Royal Charter, Bye-laws, Regulations and Rules of the ICE (2009).

² Buchanan R.A., Brunel, p.14.

The opening of the Liverpool & Manchester Railway in 1830 heralded the start of the railway age, and a consequent increased demand for civil engineering practitioners as the railway 'mania' took hold. The total membership of ICE (excluding Honorary Members) increased from about 100 in 1825 to 650 in 1850, with a sharp rise between 1835 and 1840 due in most part to an increased intake of Associates and the introduction of a new class of 'Graduates.' (Figure A1.1). But by late 1839 Brunel was cautioning Gravatt that 'the profession is overfilled, and numbers of talented men compelled to seek for employment'. Just over a year later the President of the ICE, James Walker, warned of an imminent crisis within the profession:

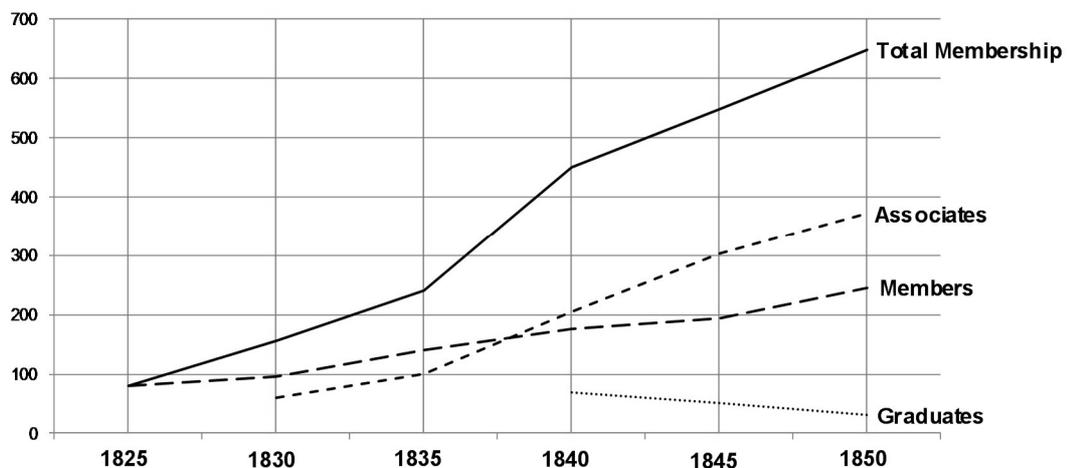
... from the number of young gentlemen who within the last ten years have studied for, or have entered, the profession, the supply is likely to be at the least equal to the demand ... The Railways ... in addition to other works of Engineering, have given employment to many. But the principal towns are already connected by Railways, or Engineers and Surveyors are now employed in projecting or executing lines where they are yet wanted. Is then the demand for professional gentlemen likely to increase? Is it not likely rather to decrease?

His pragmatic advice to those intending to become engineers was not to depend on getting work in Britain alone but:

... so to direct their studies as to fit them for other countries also, where the field is not large enough to support men who are strictly and exclusively professional ... [to succeed] a man must be a tradesman as well as an Engineer; he must furnish his hands as well as his head.¹

The first railway mania was over.

Figure A1.1 ICE Membership 1825-1850 (excluding Honorary Members)



Source: Carol Morgan, ICE Archivist, pers.com.

¹ Walker J., Presidential Address, Minutes Proceedings Institution of Civil Engineers Vol.1 (1841), pp.24-26.