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Goats Mingling with Sheep? Professionalisation, Personalities, and Partnerships between British Civil and Military Engineers, c.1837-1939

In a lecture to the Institution of Civil Engineers (ICE) in 1942, Sir James Grigg, the British secretary of state for war, observed that ‘for more than a century the members of the Institution had observed certain aloofness from their military brethren’. He highlighted the need for the two professions to start speaking the ‘same language’, and that ‘the goats’ needed to ‘mingle with the sheep’.¹ His observations suggested that the two professions — civilian and military engineering — were separate and that one group thought itself better than the other.

The relationship between civilian and military engineering in Britain has a long, intertwined history, reaching back to the eighteenth century. Yet, perceptions both at the time and within the historiography since suggest that this was a relationship characterised by neglect and suspicion, and one that only bore fruit in times of crisis. Indeed, the need for closer cooperation and a more intimate association was a recurring narrative that emerged during and after such crises, espoused by civilians, politicians, and military personnel alike. The seeming gulf between the Army and technical expertise within civil society have been reinforced by historians of the engineering profession, who have viewed military engineers as lagging behind their civilian brethren.² This depiction shifts somewhat during the First World War which, as historians of science and technology have long argued, showcased the ‘close alliance of military, industrial, and scientific communities’ and the mobility of technology and ideas between those communities, underpinning the ‘warfare state’.³ However, with a few notable

¹ A. E. Davidson, ‘Collaboration between Military and Civilian Engineers’, *Royal Engineers’ Journal (REJ)*, 56 (1942), 244-5.

² See R. A. Buchanan, *The Engineers: A History of the Engineering Profession in Britain 1750-1914* (London: Jessica Kingsley, 1989), 11; C. Andersen, *British Engineers and Africa, 1875-1914* (London: Pickering and Chatto, 2011), 5-6.

³ See E. Bruton and P. Coleman, ‘Listening in the Dark: Audio Surveillance, Communication Technologies, and the Submarine Threat during the First World War’, *History and Technology*, 32 (2016), 245-68; R. Macleod, ‘Scientists’ in *The Cambridge History of the First World War*, ed. by J. Winter (Cambridge: Cambridge University Press, 2014), 434-59; D. Edgerton, *Warfare State: Britain, 1920-1970* (Cambridge: Cambridge University Press, 2006).

exceptions, we know far less about this relationship outside the total wars of 1914–1918 and 1939–1945.

With this in mind then, the article seeks to investigate the entangled history of these two professions, exploring their relationship in peace and war, spanning a one-hundred-year period between 1837 – the year when both the Royal Engineers (RE) and the ICE began publishing professional papers – and the outbreak of the Second World War in 1939. It argues that the example of the engineers challenges lingering representations of the British Army in the historiography as reactionary and averse to using civilian expertise. Set against the backdrop of Britain’s amateur military tradition, the article reveals that for military leadership the negotiating of its relationship with broader civil society was a long-standing concern. These civil-military dynamics were characterised by tensions between formal and informal methods of association, differing perceptions of the role of the military engineer, and disagreements over the benefits of civilian expertise to contemporary armed forces — issues of enduring relevance today.

I

Contrary to James Grigg’s depiction of a century of aloofness between civil engineers and their military brethren, the relationship between the two was one marked by periods of significant intersection between the early nineteenth century and the First World War. Throughout this period, we see the establishment of key institutional structures that bound the two professions together, underpinned by a constant, low-level exchange of professional knowledge through informal interactions, lectures, and the explicit sharing of printed material.

As early as 1837, less than ten years after the ICE had been granted its royal charter, it awarded its most prestigious prize, the Telford Medal, to a serving RE lieutenant, William Denison. Denison’s winning paper focused on Canadian timber testing, which he began

experimenting with whilst working on the construction of the Rideau canal. The ICE hailed his paper as ‘an example to other Military Engineers, of the very valuable services which their opportunities will enable them to render to the science of the Civil Engineers’.⁴ 1837 proved a vintage year for both the ICE and the RE. For the former, it started publishing its *Minutes of Proceedings*, which included annual reports, the president’s address, and abstracts of papers and discussions. These were supplemented by further publications in the early 1840s, namely the *Transactions* — later renamed as *Proceedings*. For the RE, 1837 saw the production of its *Professional Papers* series, inaugurated by Denison. His intent was to ‘collect and disseminate relevant information’ to RE officers separated by continents.⁵ Through these publications, both the ICE and the RE, as collective organisations, defined and codified bodies of expert, specialist knowledge, which informed and shaped their respective identities.⁶

The passing of engineering knowledge among peers was of paramount importance to these two organisations.⁷ Publication for colleagues was a ‘fundamental social act’, binding together an otherwise geographically disparate membership. The establishment of regulated forums for communication, such as the *Minutes*, *Proceedings* and *Professional Papers*, was vital to the alignment of practices.⁸ While the inauguration of these two avenues of publication helped shaped and confirm the identity of each of the two professions, they also acted as a means of knowledge exchange between the two. Examining the library catalogues of key institutions reveals a proliferation of printed material across organisations and continents, suggesting a desire to keep up to date with developments in the broader engineering profession.

⁴ J. Weiler, ‘Colonial Connections: Royal Engineers and Building Technology Transfer in the Nineteenth Century’, *Construction History*, 12 (1996), 6-7.

⁵ C. Cookson-Hills, ‘Ubique: The Royal Engineers Establishment, 1815-69’, in *Military Education and the British Empire, 1815-1949*, ed. by D. E. Delaney, R. C. Engen, and M. Fitzpatrick (Vancouver: UBC Press, 2018), 13.

⁶ See C. Divall, J. F. Donnelly and S. F. Johnston, ‘Professional Identity and Organisation in a Technical Occupation: The Emergence of Chemical Engineering in Britain, c.1915-30’, *Contemporary British History*, 13 (1999), 57.

⁷ See W. Linssen and P. Raymaekers, ‘Engineering Institutions and Networking in Nineteenth-Century Belgium and Britain’, *Proceedings of the Institution of Civil Engineers*, 166 (2013), 28-9.

⁸ Andersen, 106.

The 1862 catalogue of the RE Library in Madras, for example, detailed a range of subjects from typical military matters, such as artillery, strategy, and tactics, to those associated with navigation and survey. However, the subject with the most material was ‘civil engineering’, entries for which ran across seven pages, and included numerous volumes of the ICE’s *Transactions*.⁹ Similarly, the ICE’s library catalogue, corrected to 31 December 1865, contained sessional papers from the Royal Engineers Establishment (REE) — the antecedent to the School of Military Engineering (SME) — and a complete run of the RE’s *Professional Papers*.¹⁰ Other organisations such as the Royal United Services Institute (RUSI), which counted both civil engineers and serving military personnel as members, represented another key site for knowledge exchange. Its 1889 catalogue listed the ICE’s library catalogues from 1851 to 1870, as well as the RE’s catalogue of 1876. It also housed the ICE’s *Transactions*, *Proceedings*, and *Minutes*, as well as a list of its members. A full run of the RE’s *Professional Papers* could be found at RUSI, as well as folios of lectures given at the SME.¹¹

The lectures given at the SME provided another means by which civil engineering expertise was brought to the attention of the RE, and considerable efforts were made to ensure such knowledge was exploited from the 1860s onwards. As part of its move to a more professional approach to military education, the SME’s commandant invited prominent engineers such as John Wolfe Barry, Alexander Binnie, and Frederick Bramwell to lecture to young RE officers at Chatham. These engineers were often past presidents of the ICE, or winners of the Telford Medal. Particular efforts were made by these guest speakers to draw parallels between the worlds of civil and military engineering. In his lecture on railways and locomotives in 1877, for example, Wolfe Barry remarked how ‘in many matters the work of a military engineer is almost identical with that of a civil engineer’, sentiments that were echoed

⁹ *Revised Catalogue of Books belonging to the Professional Library of the Royal Engineers, Madras* (Madras: Adelphi Press, 1862), 20.

¹⁰ *Catalogue of the Library of the Institution of Civil Engineers* (London: William Clowes, 1866), 347.

¹¹ RUSI Archive, 0029603, Library Catalogue, 30 April 1889, 133, 211-13.

by fellow guest lectures.¹² The SME lectures were often prepared for publication in the *Professional Papers*, which were supplied to every officer in the corps as well as each RE Library across the British empire, situated in diverse locations such as the Bahamas, Ceylon, Mauritius, and Western Australia.¹³ By codifying this knowledge in printed form, and using technological advances such as steamships and railways, civil engineering best practice was made available throughout the RE, constituting an important imperial knowledge network.

Although the reciprocal exchange of explicit, codified knowledge proved an important underpinning to the relationship, a ‘vibrant milieu’ of both information and sociability existed beyond the pages of transactions and journals.¹⁴ Through the ICE’s engineering conferences, inaugurated in 1897 and running biennially, engineers from different branches, from different corners of the empire, convened in London to discuss and present on the latest developments. Field trips were an important part of the conference and, in 1899, included a visit to the Royal Arsenal, Woolwich, to observe current developments in armaments.¹⁵ RE officers, serving and retired, also contributed papers detailing their professional experience.¹⁶ At the heart of the engineering conference was a desire to facilitate discussion and to allow informal interaction between members who rarely crossed paths. These opportunities were further enhanced by the ICE’s *conversaziones*, which were opened up beyond the immediate membership of the ICE. The *conversaziones* were evening events, held annually, which involved dinner, speeches, opportunities for social networking, as well as viewing exhibitions of engineering models and scientific apparatus. The RE supported these events in a number of ways: first, through the loan of its string band, which entertained guests throughout the evening, and secondly, by exhibiting

¹² J. W. Barry and F. J. Bramwell, *Railways and Locomotives: Lectures Delivered at the School of Military Engineering at Chatham in 1877* (London: Longmans, Green and Co, 1882), 1; W. C. Tyndale, ‘The Latest Developments of Practical Treatment of Sewage’, *Professional Papers of the Corps of Royal Engineers*, 28 (1902), 1.

¹³ J. G. Scott, *Catalogue of the Royal Engineers Corps Library at the Horse Guards, Whitehall, London* (Chatham: Institution of Royal Engineers, 1929), x.

¹⁴ Andersen, 43.

¹⁵ ICE Archive (ICEA), 624/629, Engineering Conference, 1899, Programme, 5.

¹⁶ ICEA, M656A, Engineering Conference, 1903, Records of Proceedings, Vols. 1 and 7.

or demonstrating technologies of military utility.¹⁷

While London and military sites, such as Woolwich and Chatham, served as imperial engineering and knowledge hubs, many of the encounters and interactions between civil and military engineers occurred in the empire. Military engineers, as instruments of British authority and control, had established a significant presence across the empire, serving in a variety of roles: as commanders, officials, builders of military works, and staff of public works departments.¹⁸ For civil engineers, the experience of imperial engineering was seen as ‘an effective social lever’, resulting in wealth, affluence, and influence.¹⁹ Frictions between civil and military engineers doubtless occurred,²⁰ yet there is evidence of fruitful and collaborative relationships between the two professions across the empire, both in time of peace and war. Colonel George Scott-Moncrieff, for example, remarked on the positive experience he had working with civil engineers on the Indian north-west frontier and in Peking: ‘their local knowledge, their knowledge of dealing with the natives of the country, their knowledge of the resources of the country ... was of the greatest possible use in carrying out the work’.²¹

These encounters and exchanges of knowledge were a mainstay throughout the nineteenth century, yet attempts to formalise this relationship through the establishment of various structures and institutions did not bear fruit until the early 1860s. A series of crises, including the Crimean War, the Indian Uprising, and growing tensions between Britain and France forced the civil and military professions together. Prompted by a war scare with France in 1859, the government authorised the raising of volunteer corps for the country’s protection, and appointed a royal commission to investigate provisions for national defence. This volunteer movement formed part of Britain’s amateur military tradition, which was governed by a

¹⁷ ICEA, 157146 157147 Shelf 654A, *Conversazione Programmes*, 1896-1930.

¹⁸ Weiler, 3.

¹⁹ Andersen, 166.

²⁰ *Ibid.*, 74.

²¹ G. Lacy Good, ‘Military Defence Work by Civil Engineers’, *Journal of the Royal United Services Institute (JRUSI)*, 51 (1907), 442.

preference for temporary — or auxiliary — forces, brought into existence as needs dictated both for defence against invasion and as a wider means of social control.²² The movement helped project military values to the public at large, uniting widely different social groups in a common experience, deliberately constructing an interface between the armed forces and society.²³ The volunteers were initially popular. By 1861, 161,239 men enrolled, with the number rising to 199,194 by 1868.²⁴ It was within this flurry of activity that the Engineer and Volunteer Railway Staff Corps (ERSC) was established.

Conceived as an addition to the volunteer movement, the ERSC was conceived by Charles Manby, the ICE's long-time secretary, who was 'closely associated with the leading civil engineers, contractors, and railway interests of the country'.²⁵ Despite some initial scepticism, the ERSC came into being in 1865, constituted for the 'purpose of directing the application of skilled labour and of railway transport to the purpose of National Defence' with a strength of sixty officers.²⁶ These officers were 'civil engineers and contractors, officers of railway and dock companies, and Board of Trade Inspectors of Railways'.²⁷ The ERSC represented the first *formal* attempt to link together the civil and military engineering professions, providing a direct link between the ICE and the Army, and placing the expertise of leading engineers at the service of the state.²⁸ Throughout the remainder of the nineteenth century, members of the ERSC were co-opted on to various committees to advise on coastal defences, to discuss the working of railways in wartime, as well as sit on a permanent Army railway council. The ERSC also worked closely with the RE, investigating the possible

²² I. F. W. Beckett, *Britain's Part-Time Soldiers: The Amateur Military Tradition 1558-1945* (Barnsley: Pen and Sword, 2011), 2.

²³ I. F. W. Beckett, *Riflemen Form: A Study of the Rifle Volunteer Movement* (Barnsley: Pen and Sword, 2007), 259-60.

²⁴ E. M. Spiers, *The Army and Society, 1815-1914* (London: Longman, 1980), 166.

²⁵ E. A. Pratt, *British Railways and the Great War* (London: Selwyn and Blount, 1921), vi, 5-6.

²⁶ The National Archives of the United Kingdom (TNA), RAIL 1014/17/1, Rules of the ERSC, 17 November 1908; TNA, WO 114/114, Territorial Force Establishments and Strengths, 1908-1914.

²⁷ TNA, RAIL 1014/17/1, Rules.

²⁸ The ERSC still exists today. Renamed the Engineer and Logistic Staff Corps, it now forms part of the British Army's 77th Brigade.

obstruction of railways and roads in the event of an invasion in the 1870s, and, towards the end of the century, helped administer a recruitment drive for railway tradesmen into the RE.²⁹

The scares that had brought about the establishment of the ERSC were a symptom of a broader malaise within the British consciousness: the fear of decline. These deep-seated fears were brought to a head during the Second Boer War. The shock of the initial defeats during ‘Black Week’ in 1899 and the broader deficiencies within the Army reinforced the belief that the nation was one mired in complacency and incapable of adopting ‘efficient’ approaches to business and government.³⁰ Civil engineering was not isolated from this ideology of ‘national efficiency’. In 1903, the ICE appointed a committee to examine the education and training of engineers, which explored engineer education from secondary school to the postgraduate level, as well as workplace training.³¹ There was a ‘deep conviction’ amongst British engineers that the nation’s rivals — France, Germany, and the United States — had technical education that was ‘better organised and more widely developed’.³² Similarly, within the War Office, numerous committees were established, leading to a significant period of reform within the Army.

Though subject to the broader reforms associated with the Elgin commission, Esher report, and Haldane, the RE was the target of two specific committees established to examine a reduction in the corps’ size: the 1904 Franklyn committee and the 1905 Wood committee.³³ To the chagrin of the secretary of state for war, both committees recommended an *increase* to the establishment of the RE. The Franklyn committee revealed that there was actually a deficiency in officers, primarily in the junior ranks. Ordinarily, such a deficit would be met

²⁹ Imperial War Museum, Papers of Major-General G. S. Szlumper, P105/GVS2/1/Box 1, ‘Memorandum on the ERSC’, 30 July 1942.

³⁰ G. R. Searle, *The Quest for National Efficiency* (Berkeley: University of California Press, 1971), 54-106.

³¹ ICE, *Report of the Committee* (London: William Clowes, 1906), 6.

³² ‘Report on the Education and Training of Engineers’, *The Times*, 25 April 1906, 16.

³³ W. Baker Brown, *History of the Corps of Royal Engineers*, IV (Chatham: Institution of Royal Engineers, 1952), 34-8.

through the Army reserve. However, the reserve was limited and the majority of officers within it held field rank and above.³⁴ A practical, yet radical new idea was proposed and agreed by both committees: the formation of a ‘Special Reserve’ of officers, recruited from young civil engineers and commissioned as second lieutenants.

At a lecture to RUSI in 1906, Sir John Wolfe Barry had called for ‘a more intimate association’ between the RE and civil engineers. ‘I have as you know,’ remarked Wolfe Barry, ‘taken some interest in the idea of securing for the country the assistance which civil engineers could render in time of war’.³⁵ Brigadier-General Richard Ruck, who sat in the chair, was pleased to report that the War Office had ‘favourably received’ the suggestion. In January 1908, the recommendation was formalised with the establishment of the Special Reserve, which was designed to ‘ensure that all units, services and departments of the Regular Army shall be complete of officers on mobilisation’ as well as to ‘make good the wastage which will occur in the Regular Army in war’.³⁶

The establishment of the Special Reserve was just one initiative that formed part of the Haldane Reforms (1906-1912). Though governed by the pragmatic need to reduce estimates and rationalise the auxiliary forces, Richard Haldane’s reforms were rooted in the ‘philosophical framework’ of a nation in arms — a point of continuity and evolution from the volunteer movement of the mid-nineteenth century.³⁷ He was calling for a ‘real national army, formed by the people’, which was the ‘essential point of contact in welding a unity of army and society’.³⁸ Haldane likened his national army to a military cone: regulars were the tip, the ‘sharp point of finely tempered steel’, backed by a second line of regular troops — the Special Reserve — and reinforced by a broad base of expansion and support: the Territorial Force (TF).

³⁴ Ibid., 36.

³⁵ Lacy Good, 446-7.

³⁶ War Office, *Army Orders: Special Reserve of Officers: Instructions relating to First Appointment, Training etc* (London: HMSO, 1908), 1.

³⁷ E. M. Spiers, *Haldane: An Army Reformer* (Edinburgh: Edinburgh University Press, 1980), 191.

³⁸ Beckett, *Part-Time*, 213.

Rifle clubs, school and university cadet corps would provide the long-term means of expansion.³⁹ Indeed, it was through these broader bases that further links were forged between military engineers and civil society: RE companies were established as part of the TF, whilst Officers' Training Corps at Dublin, Cambridge, Edinburgh, and Glasgow universities established engineering companies or detachments, thereby fostering closer relations between the armed forces and society, as well as improving knowledge transfer between the two professions.⁴⁰

The Special Reserve proved an especially important link between the Army and civil engineering society. For the RE, the ICE was 'solely charged with the selection and nomination to the War Office of applicants for entry into the reserve'.⁴¹ Indeed, applicants had to be ICE students who had passed the Associate Membership examination.⁴² We see here the ICE acting as an agent and 'recruiting sergeant' for the War Office, as well as providing a degree of quality control. There was also a recognition by the War Office that junior officers in the Special Reserve who 'have the opportunity of taking up civil posts, especially aboard', should be granted exemption from annual military training, particularly 'if such civil work be of a nature ... to render them more fit for the discharge of their military duties'.⁴³ Unsurprisingly, the relationship between civil work and military efficiency proved a fraught one to negotiate, and was subject to critique in the years leading up to the First World War. However, certain commentators from 1909 onwards highlighted the benefits of civilian experience, remarking on 'intellectual skill', 'raising the technical standard of the Corps generally', and that engineering qualifications should be a '*sine qua non* for all Engineer officers'.⁴⁴ For the ICE,

³⁹ Spiers, *Haldane*, 191.

⁴⁰ See E. M. Spiers, 'University Officers' Training Corps and the First World War', *COMEC occasional paper no. 4* (2015) < http://www.comec.org.uk/wp-content/uploads/2015/07/occasional_paper_no_4_no_crop.pdf > [accessed 24 June 2019].

⁴¹ ICEA, Box 277, Vol 10: Trust Funds and Special Committees 1907-1913, 29 October 1907, 74.

⁴² G. Watson, *The Civils: The Story of the Institution of Civil Engineers* (London: Thomas Telford, 1988), 61-2.

⁴³ TNA, WO 33/2985, Fourth Report on the Commission of the Provision of Officers, 12 March 1908, 4-5.

⁴⁴ F. E. G. Skerry, 'Territorial Field Companies, Royal Engineers', *REJ*, 9 (1909), 24.

the strengthening of its relationship with the RE was remarked on favourably in 1912 by its new president, Sir Robert Elliott-Cooper, himself a former militia officer and the newly appointed commandant of the ERSC:

... up to the present time 66 appointments had been made to commissions as second lieutenants in the corps [...] The conditions of service and the emoluments ... ought to render the appointments attractive to young men who were desirous of placing their technical qualifications at the service of their country in the event of national emergency, and at the same time of receiving technical and disciplinary training which could not fail to be useful to them in their civil careers.⁴⁵

Although the inauguration of the Special Reserve represented an important formal tie between the civil and military engineering professions, the numbers were insufficient. This was much the case across the Army. As Spiers notes, the Special Reserve ‘never fulfilled the optimistic expectations of Haldane’.⁴⁶ Analysis of the Army’s annual general reports between 1908–1913 bears this out. Where the officer corps was concerned, the RE Special Reserve did perform better than both the infantry and the Army total. On average, it achieved 96 per cent of its establishment targets, exceeding its targets between 1908-1910. In comparison, the infantry Special Reserve only achieved 55 per cent of its establishment, whilst the total of officers for ‘all arms’ was 57 per cent. When we look at the figures for NCOs and men, the story is very different. Despite exceeding establishments at the end of 1908, the RE Special Reserve only met 66 per cent of its establishment total on average; the infantry achieved 82 per

⁴⁵ ‘Societies and Institutions’, *The Times*, 6 November 1912, 25.

⁴⁶ Spiers, *Haldane*, 140.

cent; whilst ‘all arms’ averaged 74 per cent.⁴⁷ On the outbreak of the First World War, there were approximately seventy members of the ICE in the RE’s Special Reserve, representing less than 1 per cent of the ICE’s total membership.⁴⁸ Furthermore, aspersions were cast on the efficacy of these young civil engineers. In his evidence to the 1911 Kitchener committee, which examined the RE’s organisation and training, Colonel John Capper, the SME’s commandant, remarked how Special Reserve officers are ‘supposed to be trained civil engineers when they join and only come to Chatham to learn the more particularly military application of their science’. Ruck reminded Capper that these men ‘have to pass the examination of the Institution of Civil Engineers, which are supposed to represent a fairly high standard of technical engineering qualification’, but Capper was unequivocal: ‘my Instructors find these officers often distinctly wanting in some particular branch of engineering’.⁴⁹

The years leading up to the First World War revealed two interlinked tensions within the RE, of which the issue of the Special Reserve was a small part. The first focused on time spent on ‘works’ training (for example, the construction and maintenance of buildings, and the organisation and administration of labour) versus ‘war’ training. This issue was present in the mid-nineteenth century, with junior officers at the REE spending more time learning about construction projects than combat engineering.⁵⁰ Much of the hand-wringing came down to perceptions of military ‘efficiency’. In his evidence to the Ruck committee, one RE brigadier reflected that ‘if the instruction gained ... is not training for war then valuable time is being wasted, and efficiency for war ... is less than it would otherwise have been’.⁵¹

Those concerns about efficiency underpinned the second tension within the RE: the

⁴⁷ Figures compiled from Parliamentary Papers, ‘General Annual Report on the British Army’: 1909 Cd. 4498; 1910 Cd. 5061; 1911 Cd. 5481; 1912 Cd. 6065; 1913 Cd. 6656; 1914 Cd. 7252.

⁴⁸ A. Fox, *Learning to Fight: Military Innovation and Change in the British Army, 1914-1918* (Cambridge: Cambridge University Press, 2018), 166-7.

⁴⁹ TNA, WO 32/11378, Kitchener Report, ‘Minutes of Evidence’, 7 June 1911, 66.

⁵⁰ Cookson-Hills, 19.

⁵¹ TNA, WO 32/6920, Ruck Report, 6 February 1911, 9, 23.

balance between specialists and generalists. The Kitchener committee desired that every RE officer possess a ‘full all-round qualification for his work, since in war he must be prepared to undertake the most diverse and unexpected duties. Any specialisation must be subsequent to, and not in lieu of, this...’⁵² It was believed that training based around general principles enhanced the ‘adaptability’ of the average RE. Indeed, at the ICE’s 1911 conference on engineer education, Capper reiterated such views to his civilian counterparts, highlighting the importance of a ‘general all-round education’ to a military engineer.⁵³ Such an approach to training and education aligned with the Army’s preference for principles rather than prescription. Yet, for personnel outside the corps, the RE appeared to be *too* specialised. Writing in 1913, Lieutenant-Colonel Frederick Maurice, an instructor at the Staff College, expressed concerns that an RE officer begins ‘to specialise ... at once, in that more of his time is devoted to the study of mathematics, mechanics, and chemistry than to general military duties’. For Maurice, the RE appeared to be ‘experts first and soldiers afterwards’ highlighting the corps’ overlapping identities.⁵⁴ The seeming lack of cooperation between the RE and the other branches of the Army gave Maurice cause for concern, particularly as cooperation was an integral part of military efficiency. A swift rejoinder followed from an RE lieutenant-colonel who took issue with Maurice’s suggestion that the RE had ‘too much’ technical knowledge: ‘one so frequently hears many witticisms directed at them [the RE] and their work on account of their supposed *deficiency* in such knowledge’.⁵⁵

On the eve of the First World War, we therefore see a corps grappling with its own identity and *raison d’être*, as well as struggling to justify its position — and numbers — within the Army. In many respects, the RE was in an anomalous position: it straddled both civilian

⁵² TNA, WO 32/11378, Kitchener Report, 9.

⁵³ ICE, *Report of the Conference held at the Institution of Civil Engineers* (London: John Parkinson Bland, 1911), 14.

⁵⁴ F. B. Maurice, ‘The Engineers of the Expeditionary Force’, *REJ*, 18 (1913), 354-5.

⁵⁵ R. H. H. Boys, ‘The Engineers of the Expeditionary Force’, *REJ*, 18 (1913), 367. Emphasis added.

and military professions, and this required it to negotiate a number of — at times — contradictory requirements. It needed to specialise as well as generalise. It needed to train in peace, whilst also prepare for war. Its personnel needed to be engineers as well as soldiers. For outsiders, the RE seemed unable to satisfy these competing demands effectively. What appeared to be a constant, however, was the corps' predominantly informal interaction with its civilian counterparts. The establishment of institutions, such as the ERSC and the Special Reserve, represented an attempt to formalise the relationship between the two, building on Britain's amateur military tradition. Yet, as would quickly become apparent, it would be those informal interactions that proved most responsive to the crises that emerged.

II

The relationship between civil and military engineering during the First World War is well documented. Throughout the war, the Army made significant use of civil engineers — both inside and outside the military. Across its various operational theatres, engineers were requested to troubleshoot on hutting, water boring, and infrastructure. The approach was flexible, based on local requirements and conditions.⁵⁶ Yet, while the Army had access to civil engineers through elements of the Haldane reforms, it did not have enough. During the war, there was a variable and haphazard approach to engineer recruitment. In late 1914, Major-General Ruck approached the councils of both the Institution of Mechanical Engineers (IMechE) and the Institution of Electrical Engineers (IEE) asking them to identify young engineers for temporary commissions in either the RE or the Royal Garrison Artillery.⁵⁷ As the war progressed, the IEE president was invited to act in a similar capacity to his counterpart at the ICE in nominating members for commissions.⁵⁸ In many respects, this approach

⁵⁶ See Fox, 184-9.

⁵⁷ IMechE archive (IMechEA), COU21/1, Council Minutes, 18 December 1914.

⁵⁸ Institution of Engineering and Technology archive (IETA), IET/ORG/2/1/9, IEE Council Minutes, 28 January 1915.

represented an informal extension of the Special Reserve scheme, with the Army looking beyond the ICE to fulfil its requirements. It was not long, however, before engineering societies raised concerns about the Army's squandering of engineering resources. In a letter to the three main engineering societies, the Institution of Automobile Engineers (IAE) decried 'the profession of mechanical engineering in the Army ... to be in so unsatisfactory condition as to require investigation'.⁵⁹ It was felt by many that such an investigation was inappropriate during wartime, but it was a matter that received due attention soon after war's end.

Efforts to identify lessons and opportunities for closer working between the two professions commenced just weeks after the armistice. As early as December 1918, there was a recognition of the 'advantages to be gained by a closer rapprochement' between the RE and civil engineers. It was proposed that members of the ICE should be 'afforded opportunities of looking round the Military Engineering work both in the fighting zones and on the L[ines] o[f] C[ommunication]'. By visiting sites of engineering interest, the ICE felt it would be in a 'better position to help towards closer touch between the Military and Civil Engineering professions'.⁶⁰ Sanctioned by the Army Council, this deputation arrived on the Western Front in February 1919 and was granted access to 'all important engineering works'. One senior officer recalled how members were shown 'Ordnance, Signals, I[nland]W[ater]T[ransport], Supplies and RE Stores Depots', as well as petrol depots, a veterinary hospital, and a base remount department. He remarked how 'the place was an eye-opener' for the deputation who were 'tremendously interested in all they saw'.⁶¹ The report drawn up by the ICE detailed a number of aspects that would prove vital to future cooperation and of 'fostering ... the existing relations between the RE and the Civil Engineers, which ... are of so friendly and helpful a

⁵⁹ IETA, IET/ORG/2/1/10, IEE Council Minutes, 20 January 1916.

⁶⁰ TNA, WO 32/5104, Twining to Furse, 18 December 1918.

⁶¹ Liddell Hart Centre for Military Archives (LHCMA), Papers of Major General Sir A. M. Stuart, 7, 'Some Private Recollections of a Base Wallah, 1914-1919', 1933, 153-4.

character'.⁶² One suggestion was the desire for a 'permanent record' of wartime engineering experience to be made 'available to the Engineering profession', via the additional exchange of lectures between the ICE and the RE. Further suggestions were split into organisation, recruitment, and training. Harking back to the IAE's wartime criticisms, the report censured recruitment, notably the Army's personnel selection process, remarking that

... the Mechanical Engineer, should if required for military service, be automatically drafted into the mechanical department of the RE and not put to Railway construction or other work, where his special knowledge is largely thrown away. This appears to have been unavoidable during the present war...⁶³

Where training was concerned, the deputation recommended that '[m]ilitary officers should have a civil engineering training considerably beyond what has been considered necessary in the past', and that '[p]rofessional Civil Engineers and the larger Manufacturing Firms might give facilities for RE officers to gain experience either in their offices or on works under construction'. Such training needs were not one way, however. It was felt that the Army might take a more proactive role, offering 'facilities for military training' to young civil engineers, and enhancing the attractiveness of the Special Reserve.⁶⁴

Rather than shelving the ICE's recommendations, the report fed into one of the first, formal lessons learned committees of the post-war period: the Rawlinson committee on engineer organisation. Established in February 1919, the committee was a clear indication of the Army's desire to reassess its future engineering requirements based on its wartime

⁶² TNA, WO 32/5104, ICE Report on Western Front, 28 April 1919, 4.

⁶³ Ibid., 7-8.

⁶⁴ Ibid., 6-7.

experience. In the weeks leading up to the commencement of the committee, its chair, General Henry Rawlinson, visited headquarters across the Western Front to ascertain the ‘many changes’ required for RE organisation.⁶⁵ Yet, this was not a purely military endeavor, rather it showcased the civil-military relationship in microcosm. The committee had expansive terms of reference, including the organisation, recruitment, and training of the RE, but, significantly, it had a specific clause relating to the RE’s ‘relation with Civil Engineering’. Under that clause, the following questions were asked: ‘how are officers of the Corps in peacetime to be kept in touch with the developments of scientific engineering in civil life?’ and ‘what arrangements can be made for the utilisation of civilian specialists in time of war, and for keeping these specialists in touch with military matters in peace?’ To ensure that such concerns were addressed, civil engineers, some of whom held temporary RE commissions during the war, were co-opted onto the committee. Evidence was taken from 110 witnesses, including the presidents of the ICE, IEE, and IMechE, along with members of those societies. The resulting report, published in August 1919, put forward 109 wide-ranging recommendations, which included sending RE officers to ‘undergo a portion of their Technical Instruction at Cambridge University’.⁶⁶

The Rawlinson committee was an important milestone, going further than the various committees of the early twentieth century, in bringing the military and civil engineering professions into closer conversation. At the macro level, the committee called for the establishment of ‘Standing Engineering Committees’ — deemed the ‘foundation stone of the various recommendations’ — which would bring together RE representatives with those from learned societies, railway, and transportation services. Its duties would be to advise, *inter alia*, on ‘developments of engineering at home and aboard’, ‘the lines of research and invention ...

⁶⁵ Churchill Archives Centre, University of Cambridge (CAC), Papers of Field Marshal Lord Rawlinson, RWLN 1/11, Diary, 21 and 24 February 1919.

⁶⁶ TNA, WO 32/11379, Rawlinson Report, 1 August 1919, 8-11.

relating to Army problems', and 'the arrangements and terms for the practical training of young Royal Engineers Officers'.⁶⁷ Along with the ERSC, this committee would provide another umbrella organisation to better align the professions. At the micro level, the committee recommended that the RE, via the War Office, support a scheme put forward by the Conjoint Board of Scientific Societies, which hoped to establish a 'joint building for scientific and technical societies'. Such a building would enable 'social intercourse between members of the professions ... the interchange of views, the collection of information'. Support for such a scheme, again, spoke to the willingness of the Army and the RE to lean in to these vital opportunities for learning and discourse.⁶⁸ Serious attempts were made to capitalise on the civil-military relationship, formalising it within collaborative institutional structures.

Upon submitting the report to the War Office, the committee's secretary remarked how 'in the absence of conscription or national service, it will be necessary to court the good-will and practical assistance of the civil professions, in order to create a tangible and efficient reserve of technical officer and other ranks'.⁶⁹ He expanded on these remarks, noting that the 'Army must lean on and be closely associated with the Civil Institutions of Engineering; and it is opportune, while the friendly spirit and interest still exist ... to establish a binding liaison with them'.⁷⁰ Designed as an outward facing document, the report was subsequently distributed to the main engineering societies, Cambridge University's engineering department, and the chief engineers of the Australia, Canadian, and Indian forces. Despite its ambition, however, very few of the report's recommendations were taken up by the Army Council. The strong drive for retrenchment and the introduction of the 'ten-year rule' meant that most of the recommendations were shelved. Indeed, of the initial 109, only seven recommendations were

⁶⁷ Ibid., 61.

⁶⁸ Ibid., 61. This recommendation does not appear to have come to fruition.

⁶⁹ TNA, WO 32/11379, Mackintosh to Director of Staff Duties (DSD), 17 September 1919.

⁷⁰ TNA, WO 32/11379, Mackintosh to Chief of the Imperial General Staff, 17 September 1919.

put into practice during the twenty years following the Rawlinson committee's report.⁷¹ While the appetite for closer working was apparent, it was often at the mercy of political and financial exigencies.

One of the recommendations that took root relatively quickly, however, was the decision to send junior RE officers to complete part of their education at Cambridge University. This measure was initially borne out of expediency and ad-hocism. Over 400 junior RE officers had received only partial training during war, and required supplementary courses to complete their education. Attempts were initially made to put these officers through courses at the SME, but the ceiling for each course was twenty-five officers.⁷² As the SME's newly appointed commandant, Major-General Henry Thuillier was directed to liaise with Cambridge University in line with the Rawlinson committee's recommendations. The RE wished for their junior officers to undertake the three-year mechanical science tripos in one year. What appeared to be a tall order was aided immeasurably by the presence of Professor Charles Inglis, the new head of Cambridge's engineering department, a member of the ICE, and a temporary RE officer during the war who had served as an instructor at the SME. He was most keen to bring about an 'entente between Chatham and Cambridge'.⁷³ Between Inglis and Thuillier, provision was made for fifty officers per year to attend the university in 'supplementary classes', which ran from 1920 until 1925. The War Office agreed to pay tuition along with other fees and expenses. 'The public should reap indirectly much advantage from the very superior instruction that is given here', reasoned one RE officer, 'and surely the public should pay'.⁷⁴

Satisfied with the instruction offered to the supplementary classes, the Army considered a more permanent arrangement with Cambridge, cementing the Rawlinson committee's

⁷¹ Institution of Royal Engineers (IRE), *History of the Corps of Royal Engineers*, VII (Chatham: Institution of Royal Engineers, 1952), 149-50.

⁷² *Ibid.*, 157-9.

⁷³ Cambridge University Library (CUL), MS Add.8091/2/1, 'Address to RE Officers', 1922, 1.

⁷⁴ TNA, WO 32/3060, Addison to Thuillier, 2 February 1921.

original recommendation. This arrangement was in response to advances in engineering science. Writing in the *REJ*, Thuillier remarked how

[i]f we remain satisfied with the standard which was considered good enough before the European war for our military engineers, while the engineering sciences and practice of civil life are advancing by leaps and bounds, the inevitable result will be that the engineer services of the Army in peace and war will fall off greatly in efficiency, and this will in turn seriously affect the efficiency of the Army as a whole.⁷⁵

Once again, perceptions of military ‘efficiency’ remained a key concern. Yet, for the RE, efficiency now meant a more fulsome appreciation of developments in civilian engineering. Thuillier’s proposals for a more permanent partnership with Cambridge were put before the 1923 Haldane committee on the education and training of officers. The committee agreed to the partnership, recommending a blended approach to learning with time spent at both the SME and Cambridge, amounting to two years and nine months in total — an uplift of almost a year from the existing SME course — with the majority of time spent at university. Time spent in professional education sought to make good on the ‘very unsatisfactory’ position of the SME’s courses, which were ‘congested with technical detail beyond the power of the average officer to assimilate in the time available’.⁷⁶ Accepting the Haldane committee’s recommendation, the War Office agreed to the permanent partnership, which, after some initial financial wrangling, was put into effect in October 1926. By the outbreak of the Second World War, practically all RE junior officers had the Cambridge honours degree in engineering, whilst more than half the

⁷⁵ H. F. Thuillier, ‘Professional Note: The Technical Training of Engineer Officers’, *REJ*, 35 (1922), 19-21.

⁷⁶ LHCMA, Papers of Captain B. H. Liddell Hart, 15/3/55, Haldane Report, 1924, 23-4.

corps itself had been to university.⁷⁷

The long-standing partnership between the RE and Cambridge was important for three reasons. First, it was pedagogically innovative for the time, representing one of the first academic-military partnerships for the UK's armed forces, and a move towards the professionalisation of military education. Universities were better able to keep pace with developments in 'engineering science and practice in the commercial world' in a way that the SME was not, while those officers who had been to Cambridge were deemed as having a 'distinctly wider outlook, a more mature judgement and were more receptive of teaching'.⁷⁸ This receptivity formed a key element of Professor Inglis' teaching philosophy. He strove to give RE officers 'intellectual independence and freedom', providing them with engineering *education* rather than technical *training*, and impressing on them that 'the value of education is measured by the habit of mind which remains when you have forgotten all the facts you were ever taught'.⁷⁹ Secondly, the RE fully embraced the need for education that was prescribed by civil engineering society. One RE officer at Cambridge remarked on the legitimacy that such education conveyed: the engineering degree was 'of itself, a passport to the respect of civilian engineers'.⁸⁰ The decision brought the RE officer corps in line with developments in civilian engineering education more broadly, providing officers with that vital theoretical education to complement their technical training.⁸¹ For Thuillier, he was in no doubt that RE education 'must be of the same standard as that of civil engineers'.⁸² Finally, and perhaps more importantly, RE officers were embedded with their civilian brethren. At Cambridge, they were required to wear cap and gown, not military uniform. They were subject to university and

⁷⁷ IRE, 162.

⁷⁸ Thuillier, 28; Anon., 'The Education of R.E. Officers after the 1914-18 War', *REJ*, 59 (1945), 261.

⁷⁹ CUL, MS Add.8091/2/1, 'Address', 2-3.

⁸⁰ J. Innes, 'Engineer Training', *REJ*, 52 (1938), 181.

⁸¹ See R. A. Buchanan, 'Engineers and Government in Nineteenth-Century Britain', in *Government and Expertise: Specialists, Administrators, and Professionals, 1860-1919*, ed. by R. Macleod (Cambridge: Cambridge University Press, 1988), 55-7.

⁸² Thuillier, 26.

college authorities, rather than the military chain of command. Mixing and networking with fellow students was deemed of great value to RE officers, whether in recreation or study. Indeed, informal networking was almost as important as the intellectual endeavour itself. Although there were fears within the Army that some officers may ‘run wild, neglect their studies, or develop undesirable eccentricities of thought and behaviour’, the potential for broadening their mental outlook and forging important links with men of ‘intellectual power’ and originality destined to make ‘their mark in public life ... in the scientific and learned professions or in the commercial world’ made the risk worth taking.⁸³

While the benefits of this partnership were manifold, the financial wrangling that had delayed its establishment soon began to threaten its very existence. Value for money and return on investment were twin obsessions aired in the service journals and newspapers of the time. Only two years after the course was established, the Army had ‘already complained that it is not receiving the benefits, of which it has a right, from the ‘costly education’ of the RE officer.’⁸⁴ However, attitudes within the Army seemingly militated against the more effective use of RE officers, particularly in the early 1930s. Major-General Charles Bonham-Carter, who served as DSD at the War Office, recommended that, as ‘exceptionally highly educated Engineers’, RE officers should ‘run the enormous task of managing the [mechanical] repair service in war’.⁸⁵ Bonham-Carter, however, was overruled. Matters came to a head just before the outbreak of the Second World War when, in June 1939, the Cambridge course was ‘abandoned’ by the War Office. The ICE president, William Binnie, was outraged:

[N]o action could be better designed to produce the impression that to Royal Engineer Officers engineering education is a luxury rather than a necessity and if this opinion

⁸³ Ibid., 29-30.

⁸⁴ Pseud., ‘The Functions of the Military Engineer in the Army of Today’, *REJ*, 42 (1928), 56.

⁸⁵ CAC, Papers of General Sir C. Bonham-Carter, BHCT 9/3, Autobiography section 1, c.1954, 12-13.

becomes widespread, as must inevitably happen, the Corps as an engineering authority will cease to be regarded with that respect which is so eminently desirable.⁸⁶

Leslie Hore-Belisha, the British secretary of state for war, responded in kind, citing that the current state of national emergency required the movement of the RE to a war-footing and its consequent withdrawal from the university. Binnie was not to be discouraged, however. In August 1939, the War Office reversed its decision under pressure from the ICE, resuming the RE's education at Cambridge.⁸⁷ The Army was often the intransigent partner in this relationship, forced to rob Peter to pay Paul, and balance commitments in an era of increasing complexity and opacity. As one historian has argued, it is probable that no army has faced 'more complex or greater challenges than the British Army did between the two world wars'.⁸⁸

Although the Cambridge course represented an important effort to formalise the relationship between the military and civil engineering professions, these attempts remained limited in their scope and confined to those of the rank of captain or below. Once promoted, there was little opportunity for RE officers to establish formal relationships with civilian counterparts to say nothing of the experience afforded to other ranks and NCOs. At the corps' senior levels, an RE Board — another of the Rawlinson committee's recommendations — was appointed to oversee the experimentation and design of engineering equipment and material.⁸⁹ This was a civil-military-academic partnership with board members including Professor Charles Inglis, and the presidents of the ICE, IEE, and IMechE, which sought to harness civilian expertise for the benefit of the military. Yet, despite these efforts, there was a gulf between those near the coal face of the RE and those at the top with very little in between to

⁸⁶ ICEA, Box 57 Pickfords, Binnie to Hore-Belisha, 21 June 1939.

⁸⁷ ICEA, Box 57 Pickfords, Gordon-Finlayson to Binnie, 11 August 1939.

⁸⁸ J. P. Harris, 'Obstacles to Innovation and Readiness: The British Army's Experience 1918–1939', in *The Past as Prologue: The Importance of History to the Military Profession*, ed. by W. Murray and R. H. Sinnreich (Cambridge: Cambridge University Press, 2006), 215.

⁸⁹ See TNA, WO 187/2, *Extracts from Proceedings of the Royal Engineer Board* (London: HMSO, 1922), 3–6.

ensure formal cooperation between the two professions.

Such a situation led to calls, once again, for a ‘very much closer liaison between military and civil engineers’.⁹⁰ This gulf was partly bridged by continuous, low level exchanges of knowledge and experience in informal settings. Engineering societies were called on to act as recruiting sergeants in the early 1920s, willingly advertising to its members the RE’s requirement for individuals with technical qualifications and skills to serve in either the Territorials or the reserve.⁹¹ RE officers were invited to give lectures to engineering societies on how the various sub-sets of engineering were employed and progressing in a military context. For the IMechE, the interwar years saw the first instance of a serving RE officer appointed to its council. That officer, Colonel Alexander Davidson, would become the IMechE’s president in 1935.

These highly individual efforts maintained a steady cadence between the two professions. Yet, the reliance on pragmatic, informal methods, primarily driven by individuals, often led to the re-learning of lessons, reinforcing the highly — yet unavoidably — cyclical nature of the Army’s relationship with civilian expertise. The ICE and others continued to offer olive branches of assistance and support to both the Army and RE, but there was a reticence to commit on the military’s part. In 1937, as ICE president, Alexander Gibb raised his concerns with Sir Thomas Inskip, Minister for the Coordination of Defence, referring back to the lessons of the First World War. For Gibb, there was ‘no system then, and to the best of my belief there is no system now ... in regard to the proper utilisation of our qualified engineers’.⁹² It was clear that concerns raised during and immediately after the First World War had still not been addressed in a manner satisfactory to the engineering societies. The Army’s limited role in national strategy coupled with its continual struggle for vital resources hamstrung its ability to

⁹⁰ L. V. Bond, ‘The Military Engineer in Modern Warfare’, *JRUSI*, 83 (1938), 770.

⁹¹ IMechEA, COU24/2, Council Minutes, 23 April 1920; IMechEA, COU27/1, Council Minutes, 27 May and 23 September 1921.

⁹² ICEA, Box 57 Pickfords, Gibb to Inskip, 21 July 1937.

better formalise the relationship with its civilian brethren. While the Army can be seen as complacent in its preparations against a resurgent Germany, its confused interwar role and peacetime domestic inactivity offers only a partial reprieve for its inconsistent approach towards civilian expertise.⁹³

III

Reflecting on his experience of the relationship between military and civilian engineers in 1950, one anonymous Royal Engineer remarked that ‘both sides have tended at times to underrate the worth of the other ... failing to understand each other’s problems [...] both sides must appreciate each other’s points of view and “speak the same language”’.⁹⁴ These comments encapsulate the enduring tensions within the historiography which have characterised the relationship between civil and military engineers for much of the previous century, whilst highlighting the inherent challenges of maintaining a functioning partnership in the face of financial pressure, scientific change, and military necessity.

Comments such as these have led many historians to view the relationship between the two professions as one marked by neglect and intransigence on the part of the Army. Yet, this is only half the story. As this article has demonstrated, the two professions had longstanding links formed upon firm foundations of mutual interest and respect. To a considerable degree, this was due to the overlapping military and professional identities within the RE. Members of the RE were civilians, engineers, and soldiers. These fluid identities were a point of tension, but also an overwhelming strength for the corps, which acted as an important bridge with civil society. As one officer remarked, the RE ‘must speak the language both of the General Staff

⁹³ D. French, *Raising Churchill’s Army: The British Army and the War against Germany, 1919-1945* (Oxford: Oxford University Press, 2000), 275; E. Smalley, *The British Expeditionary Force, 1939-40* (Basingstoke: Palgrave, 2015), 218, 223.

⁹⁴ Anon., ‘Civil and Military Engineers’, *REJ*, 64 (1950), 407.

and of the civilian or military expert designer.⁹⁵ Yet the relationship was not merely the product of mutual admiration: its survival and continual renewal was dependent upon the Army's enduring appetite to extract value from civilian experts. Military authorities were keen to exploit the intellectual, industrial, and manpower resources of the nation and the empire. In turn, wider civil society had a stake in military organisation and training, and could exert pressure on the War Office to change its mind.

For all their unique and arcane features, armed forces cannot be extracted from the societies they serve or the contexts in which they operate. The story of the relationship between the RE and civil engineering is thus not one of cyclical 'forgetting', but rather a continual process of re-negotiation and renewal to meet new challenges and altered contexts. Where there is continuity though is in the importance attached to civilian involvement in the military education of the RE officer corps. By investing considerable sums of money into RE education and partnering with a civic university to deliver this education, the Army benefitted from an officer corps with minds 'trained to a pitch of independence', ready to think through and grapple with the problems — and wars — of tomorrow.⁹⁶

⁹⁵ Pseud., 51.

⁹⁶ CUL, MS Add.8091/2/1, 'Address', 3.