The role of the civil engineer in society: engineering ethics and major projects

By Prof Richard Ashley

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Introduction

A call was made by Prince Charles in his sustainability lecture (NCE, 2012) to revisit the definition of civil engineering especially as he saw the profession playing a crucial role in tackling future challenges such as climate change. It is now timely for professional civil engineers to not be afraid to say what they really think to government, clients and employers. The Profession firstly serves mankind and everything we do needs to take a global perspective. However, personal fears may be inhibiting an ethical stance for many.

Economic constraints and local interests have made it much more difficult for many civil engineering professionals to adhere to the clear ethical principles of formulation and adherence to a set of values or beliefs; a core component of social and technical progress (Hodgkinson & Sohail, 2003). In this the individual needs to subscribe to the corporate ethic, i.e. for the purposes of this discussion the rules, principles and codes which are built around and define the ethics of the Institution of Civil Engineers, irrespective of the individuals' employment or professional practice position. All professionals should regularly consider the ethics of their position and the work they are involved in (Fan, 2003). Professional challenges, disagreements, dichotomies and dilemmas are inevitable and taking an ethical view can help inform decision-making and be the source of technological development rather than a constraint (van den Hoven et al, 2012).

The Civil Engineers' work is defined by boundaries. Nowadays the two most important of these boundaries are: (i) the working boundary, as an employee or self-employed professional practitioner, and; (ii) the job boundary, where the scope, scale and overall physical and temporal boundaries of the work in hand are set. In the working context, the professional, however engaged, has a duty to comply with the ethical and conduct standards set by the Institution (ICE, 2004; 2008) and have regard for the wider standards expected notably by the Engineering Council. A challenging requirement is that for the professional 'to only perform services in areas of current competence' (Royal Academy of Engineering, 2011); especially where there is innovation that inherently brings new risks and uncertainties into the work.

There is a third boundary, that related to the information made available to the client and how it may be constrained or presented in a particular way and to whom. In an open system the information about the scheme, both locally and in a wider context would be made available to the paying client and to society as a whole. Professionals have a difficult task in deciding what information and how best to make this available in a way that can best be understood in an increasingly complex world where non-experts are struggling with the rapidly increasing body of knowledge held by increasingly polarised experts who in turn, frequently disagree about the best course of action (Naustdalslid, 2012; Laws & Loeber, 2010). This is a paradox, given humanity's growing ability to manipulate and change natural systems and requires professionals who can recognise these challenges and rise above often too locally focussed stakeholder interests.

The use of sophisticated computer models is perhaps the greatest change in the engineers' practice in the past few decades and making the functioning and results from these models clear to clients, together with the correct range of uncertainties in the analysis, is a major challenge when sharing information. This can lead to decision making that is sometimes misguided where the form and amounts of information provided have not been the most appropriate. This is illustrated by the use of sewer flow and quality models to decide upon large investments in cleaning up polluting discharges into the environment. These models typically have a precision of within some 20% when applied to flow rates and volumes, but are inaccurate when considering pollutant loads, with uncertainties ranging up to 200%, with one commentator (Willems, 2008) suggesting that a random number generator would be just as useful. In England, consultants, regulators and sewerage undertakers rarely if ever acknowledge these uncertainties, which with a changing climate can only become greater in the future (Schellart et al, 2010). There is a general need to reframe how such uncertainties are handled and presented professionally if they are to be coped with appropriately in terms of the big challenges ahead (Brugnach et al, 2008).

Whether or not the professional is an employee, as a professional, any service should be delivered with integrity to ensure that the clients' needs are met in the best way possible; but at the same time to guide the client to understand better what is really needed to solve a problem and take advantage of opportunities. At times this may mean that the needs of the employer, where the professional is employed by a private or public organization, have to be subordinated in the best interests of the client. A professional in such a position has to try to ensure that the immediate client (their employer) and the project client are both served well by their work as a professional. Ideally this should also serve the needs of society. They also need to be able to argue persuasively for their views and deal with the dilemmas arising from alternative views and interests (Laws & Loeber, 2010).

In the early days of civil engineering as a profession, engineers were often promoters of projects themselves, being responsible for fund raising and gaining political acceptance for a scheme, thus serving the role of both client and professional in 'progressing' society, where virtually any civil engineering works were clearly of benefit to the wider social good. The boundary question arising from this is 'who is the client'? When Tredgold in 1828 defined civil engineering at the time of the establishment of the Institution he was taking a visionary stance that demonstrated the vital role civil engineering endeavour had for mankind, as "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, 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].

Prince Charles' 2012 sustainability lecture (NCE, 2012) underlined the urgency of acknowledging and acting differently to address today's and future challenges and suggested that ICE had a central role in this but needed to refine its' charter to alter how civil engineering professionals see their role in order to align more with working with the environment rather than 'directing' it. Especially as many historical civil engineering projects had been deleterious to the environment, using up precious non-renewable resources, and creating climate changing wastes: "engineers must realise the importance of using lower carbon materials and more natural techniques". The view for a need to subtly change what civil engineering is had previously been expressed in a 2003 ICE Council Task Group, where 'directing' was recommended to be replaced with 'working with' and the word 'society' replacing 'man' in the Tredgold definition. The sustainability charter (2003) and a revised definition of civil engineering by Council in 2007 as "a vital art, working with the great sources of power in nature for the wealth and well-being of the whole of society" indicated an emphasis on the societal and environmentally sympathetic nature of civil engineering's mission. The Engineering Council, in their inter-institutional guidance on sustainability (Bogle, 2010) re-emphasise the ethical dimension to engineering endeavours and state six principles (engineers should):

a) Contribute to building a sustainable society, present and future;

b) Apply professional and responsible judgement and take a leadership role;

c) Do more than just comply with legislation and codes;

d) Use resources efficiently and effectively;

e) Seek multiple views to solve sustainability challenges;

f) Manage risk to minimize adverse impact to people or the environment

The guidance (Engineering Council, 2009) further elaborates on each principle. For example, (b) includes requirements for the engineer to: look at the broad picture; be prepared to influence the decision-maker for a project; identify options that take account of global, economic, social and environmental outcomes; ensure that the solutions and options are offered that will contribute to sustainability; be aware that there are inherently conflicting and unmeasurable aspects of sustainability. Such definitions, ranging from the fundamental tenets of civil engineering through to a new view of engineering as a whole based on contemporary understanding of today's science and society's needs, clearly place the boundary of civil engineering endeavours as widely as possible no matter what the scheme. Nowhere in the statements of principle, ethical considerations or other guidance is the definition of the 'client' constrained to mean the boundaries of the job in hand; rather it is clear that the proper boundary is society and the environment as a whole.

Unfortunately, for many civil engineering employees especially in large organisations, their ability to apply these principles is defined by their employer, who may also be a public body, rather than the wider world or their own understanding of professional ethics. The art of corporate social responsibility may or may not serve the same principles as the professional civil engineer, as employer organisations in themselves serve many masters, not least shareholders (Barry, 2003).

There can be major tensions as a result of the need to balance professional activities between the various boundaries constraining, yet at the same time opening up, the range of activities within which civil engineering endeavours are carried out – e.g. designs for a new motorway bridge need to consider both the details of the bridge itself in terms of strength, materials etc. and also at the same time, the wider implications of traffic use in the future as well as the construction use and potential depletion of resources and emission of greenhouse gases, as a wider more globally impacting consideration. However, depending on the clients' brief, whether or not there is the need for the bridge in the first place may or may not be considered within a wider societal and environmental perspective. Yet, it seems that civil engineers are mostly able to balance their activities successfully avoiding transgressions of the codes of ethics and professional conduct, especially where the professional is working for a large organisation. McGowan (2012) reported that the majority of those found guilty of professional misconduct by the Professional Conduct Panel of ICE were either individual practitioners or part of a small consultancy and that the misdemeanours concerned inadequate client communication or not keeping up to date as regards practice. Given the complexity of today's world and how best to 'work with the great sources of power in nature for the wealth and well-being of the whole of society' envisaged for each and every civil engineering scheme, it is surprising that more members of the Institution are not adjudged of misconduct or at least of not performing 'services in areas of current competence'.

The ethical challenge

Engineers have long been proud that they do what anyone can, but they do it better, more efficiently and more cost-effectively. Civil engineers rightly can claim a special place in 'directing the great forces of nature for the benefit of mankind'. Self-evidently the works done by our forebears almost always benefitted mankind, in the widest sense as well as benefiting the immediate client (the one who paid). Definitions of civil engineering also include references to 'problem-solving'[2] often resulting in a preoccupation with 'problems' rather than opportunities by engineers. Maximising the benefits and solving problems seem to be good definitions of what civil engineers actually do.

Nowadays, perhaps more than in the recent past, the multiplicity of professions involved in infrastructure and the built environment requires a new way of collaborating and even a new type of engineer. The current problems and opportunities that go with this require a move away from the traditional engineering reductionism of complex phenomena into simple constituent elements in order for society to apply traditional engineering skills to find practical solutions to problems in nature such as climate change. Recognising the importance of the interface between nature and society has never been more important than it is now and recent ideas and guidance about ecosystem services are helping with this (e.g. Everard, 2011). The new, or perhaps restated, boundaries to engineering need to help professionals move away from the traditional engineering technocratic perspective in order to include a wider range of knowledge, especially concerning societal values and interests (Naustdalislid, 2012). In the past, large infrastructural schemes were appropriate in which 'big' engineering converted natural resources into useful artefacts and services. Now, minimisation of the use of resources is essential as is reduction of emissions of any sort. Such moves also require the embracement of the wider principles of engineering ethics to ensure societal and environmental needs are fully met. Is it for example, enough to devise solutions to problems that do not ensure that as wide as possible benefits and opportunities for society and the environment are embraced, if that is what the client wants? The presence of compelling legislation or regulations should not constrain the professional engineer from doing things differently, ((c) in the introduction) although concerns about innovations and their efficacy can rightly inhibit recklessness ((f) in the introduction).

The perceived sustainability of organisations themselves can constrain innovation and the use of wider boundaries in engineering. When moving from one regime to the next in terms of innovations in practice, it is not sufficient just to challenge the technological paradigms; the institutions and the governance arrangements that deliver the supplanted practices are also likely to need to be changed as well (Brown et al, 2011). In the water industry, the stationary design and operational assumptions, related to historically slowly changing external drivers (Milly et al, 2008) and the continuing investments underpinning the large technical systems (asset management) provide inevitable conditions for 'technological entrapment' (Walker, 2000) or 'lock-in' to perpetuating their use as the perceived 'common-sense' approach; one enshrined in institutional cultures, such as held by the Environment Agency in England (Palmer, 2000).

Examples of ethical dilemmas – or simply healthy professional disagreement

There is some evidence that today's civil engineers are providing services to clients with only limited challenges to the scope of the brief or are encouraging over-engineering and not delivering value for money; clear examples of unethical behaviour if true. Many schemes serve single outcomes for society, unlike the Dutch Room for the River programme, where investing in 'quality' of the environment is an integral part of the process of increasing the conveyance of river flows across the country (van Herk et al, 2012).

Recent examples of potential complaints about unprofessional practices include concerns about over-engineering of the completed A46 Newark to Widmerpool improvement (Greenwood, 2012) and the proposed New Wear Bridge in Sunderland (Wynne, 2012) and the viability and advisability of the proposed HS2 rail link (The Economist, 2012). For every concerned correspondent there are invariably a number of supporters of these schemes. While there will always be professional disagreements about the best option to fulfil a particular societal need, it is the ethical duty of all professionals to provide advice and information that is impartial, well-balanced and using the best available knowledge. Civil engineers' involvement in these and other schemes usually begins only once the project has been decided upon and not at the inception when it is decided whether or not the project is needed at all. With the advent of the new National Planning Policy Framework 2012 in England, the streamlining of the planning process is likely to result in fewer challenges to big schemes (an intention of DCLG), seemingly contrary to the promotion of localism through the Localism Act 2011. Should professional engineers then simply press on with designing the best scheme for a client where there are clear flaws in the original definition of the needs and requirements? Taking a societal stance, perhaps the original definitions need to be reconsidered and an alternative approach developed to fulfil the original need. Many of these schemes are claimed to be 'spending of money beyond all sense' providing very limited benefits (Jenkins, 2012).

Big infrastructure schemes are seen as the bread and butter of civil engineering and invariably as "vital to the Nation's future" (Oliver, 2012). Principally, HS2 has been lauded by the Secretary of State for Transport (NCE, 2012a) as building on the Victorian railway legacy similarly to the plans for the proposed Thames Tideway Tunnels, where the legacy of Joseph Bazalgette's intercepting sewers in London has been used to promote the tunnels and for which the recently returned Mayor of London stated that "future generations of Londoners will thank us for taking forward this bold vision" (Water Active, 2008). How a 'bold vision' can be seen to come out of an approach used 150 years ago is confounding. Elsewhere in the world, a green infrastructure approach is being taken wherever possible (e.g. in Philadelphia, Ashley et al, 2011) keeping storm water on the surface as far as practicable and recognising it as a resource (Thurston, 2012). This approach has been shown to add considerable additional benefits to urban life; some $3bn in Philadelphia from using green infrastructure for 50% of the management of stormwater runoff. Achieving this was not easy for the professionals concerned (CDM Smith consultants) who had to fight many battles over more than 5 years to make the regulators and fellow professionals understand the potential value of taking a green infrastructure approach through retrofitting across the city. This required significant resourcing and commitment at the highest level in the City of Philadelphia (Maimone, 2012).

In the London Plan 2011 (GLA, 2011), the Mayor wants to make the city one of the greenest in the world, yet has failed to make the connection between continuing to drain the city as it has always been drained by building the new sewer tunnels to take the runoff, and the need for stormwater to be used on the surface to irrigate the new green city especially at a time of water stress (Gard, 2012). Greening is not the only opportunity in London provided by surface water. Blue-green cities where water is evident help to cope with climate change and provide a wealth of water-related multiple benefits including place making and quality of life (Digman et al, 2012). Adopting a Philadelphia style approach in London is said to be too expensive and too difficult and not 'common-sense' (Thames Water, 2011). The old ways are the best ways and 'we know they work'. They do when addressing a single problem, but at what costs? We now know about environmental impacts from big infrastructure and especially about the causes of climate change which many schemes have contributed to in the past and traditional practices are known to be unsustainable (White & Howe, 2004). We also know about the need to maximise value to society in everything a civil engineer does - surface water can provide significant added value and schemes that address only single problems as the London sewer tunnels do are no longer affordable. Any competent professional should be aware of this.

The proposed London sewer tunnels illustrate the complexity of today's problems and the divergence in professional opinions as to how best to deal with these; they also illustrate the conflict between best value for society and the immediate client. In many ways the proposals are an example of the classical approach to civil engineering challenges (seen as a problem). The client, Thames Water Utilities is acting on behalf of a wider client, London and UK society, and also contributing to improvements to the aquatic environment by minimising the numbers and volumes of combined sewer overflow (CSO) spills into the River Thames (Thomas & Crawford, 2010). There is a single problem, the solution to which is to construct new tunnels, mainly beneath the river bed, to store excess overflow spills, which will then be pumped back up for treatment. In Bazalgette's day, the intercepting sewers were self-evidently benefiting society and these sewers have provided healthy conditions for the populace for decades, despite the doubters at the time, who were concerned with the centralisation of sewage management (Allen, 2008; Charles, 2009).

Since the great public health revolution in the mid 1800s, where the key building blocks of public health engineering were laid down, much knowledge about urban drainage has been developed and the use of computers has facilitated more detailed analysis than ever before of the performance of systems (e.g. Butler & Davies, 2011). This has provided new ideas and also the opportunity to test out, by computer simulation, a wide range of options (Thomas & Crawford, 2010). At the same time as confidence has risen regarding the ability to estimate rainfall, the way in which urban hydrology functions and the potential polluting impacts on receiving waters of urban runoff, emerging ideas have come to regard all forms of water as potentially beneficial, especially where climate or weather variability is threatening supply security (e.g. Howe & Mitchell, 2012). The growing knowledge about climate change is clear that whilst there may have been a period in history where predictions of the performance of urban drainage systems could be made with some certainty, this no longer pertains and past records are scant indications of how rainfall and runoff will behave in the future (Milly et al, 2008). Therefore professionals are faced with chronic and significant uncertainties about the future and the way in which any new infrastructure will perform, just at a time when computer models appear to provide some certainty. There has never been a more significant period in history where the uncertainty of analysis and the building in of adaptive flexibility into infrastructure has been more important (Gersonius et al, 2012). Clearly in Bazalgette's day there were major uncertainties in environmental and other factors and good engineering judgement had to be made to ensure that appropriate safety factors were included. The difference today is that there is very little time and opportunity to act to avert the coming impacts from climate change (as stated by Prince Charles) and yet engineers and other professionals are failing to change the practices fast enough that are known to exacerbate climate change and which fail to provide the resilience required to reduce future vulnerabilities in society (Naustdalslid, 2012; Gersonius et al, 2012).

In London the amount of energy needed to pump the 39Mm^3/year of water from the new sewer tunnels up some 60m is 15,000,000 kWh/year (Thames Water, 2005). Despite this, no carbon footprint or carbon impact assessment for either the operation of the tunnels nor for the construction has been undertaken or even required by the client or by the overseeing department, Defra. This is despite Ofwat's (the water industry regulator) requirement for the water companies to report their carbon footprints for the last asset management planning round in 2010. In 2010, Thames Water opened a new 140Ml/day desalination plant in London to deal with peak demands, given the go-ahead following “a victory for common-sense” according to Thames Water’s chief executive (NCE, 2008).

The construction of the new sewer tunnel and desalination plant, represent a substantial economic investment, in excess of £4bn capital, a substantial amount which increases the value of Thames Water’s capital assets and hence their capitalisation and attractiveness to investors. It ensures future ‘lock-in’ to the use of these assets, even where the high energy demands of their use are likely to become untenable for the future generations that the Mayor of London thinks will be thankful. Resilience and adaptability to climate and other changes requires flexibility, redundancy and the ability to abandon or ‘transform’ with ‘no regret’ responses that are not working (Ingham et al, 2007; Blackmore & Plant, 2008). Large infrastructure projects such as those in process of being built in London may have a place where the degree of uncertainty about the future is low, but where there is substantial uncertainty, responses need to be more inherently flexible, utilising a diversity of responses, with abandonment or significant alteration, a clear option if necessary (Evans et al, 2008).

This raises the question for London: why is a large sewage storage system being built at the same time as a desalination plant, when the problem addressed by both is stormwater? For the tunnel, it is too much stormwater overflowing from the sewerage system; whereas for the desalination plant it is not enough water? Why not utilise the stormwater near source to solve both problems as advocated around the world (Centre for Water Sensitive Cities, 2012)? Ironically the new tunnel will have no benefit for the increasing flood risk within London and this will require additional measures; proposed by Thames Water (TW) as yet more large sewers, despite the recognition by others that new sewers are no longer the answer to this problem (Pitt, 2008; Ofwat, 2009). It appears that the dominant regimes within which Thames Water and the professionals involved and the other agencies operate make this approach the ‘common-sense’ one for all concerned.

It is not only engineers who are faced with potentially conflicting loyalties and interests, environmentalists in particular have held significant sway over the constraints within which engineers have had to operate for many years. Recently the anthropogenic benefits accruing from environmental goods and services (known as ecosystem services) have been acknowledged and, via a monetisation approach are being used in benefit-cost evaluations (Everard, 2011). Nonetheless, environmental scientists are also implicated in failing to take due account of the trade-offs between one environmental improvement and another consequent impact (e.g. Sarewitz, 2004). There are ‘tendencies of a bipolar development within the environmental movement’ (Naustdalslid, 2012) where some environmentalists are still pursuing classical issues and nature protection, whilst others are concerned with the threats of climate change. Often the activities of the former in addressing single issue environmental protection policies lead to impacts in terms of adding to the climate change problem.

The Tideway sewer tunnel is an example of this. The Environment Agency set the standards and targets for compliance with the Urban Wastewater Treatment Directive for the proposed sewer tunnels in London. In a Commission of inquiry (Hammersmith & Fulham et al, 2011) evidence from the EA provided little scientific and credible information about the relative amounts of oxygen and bacteriological pollution arising from the CSO spills, wastewater treatment plant inputs, background diffuse runoff from roads and other surfaces in London and coming from upstream into the river reach. Questioning of the EA and Thames Water regarding the wider energy use and carbon impacts of the tunnel solution went unanswered. At no time were the marginal benefits of collecting spills from many of the overflows compared with the high consequent increase in overall scheme costs. Nor were the considerable modeling uncertainties made clear and linked to the benefit-costs of the scheme. In fact the EA used an internal verification process to confirm the way in which the final decisions as to which CSOs needed to be connected into the tunnels, rather than an independent and publically verifiable process. Therefore, marginal aquatic environmental benefits obtained by connecting certain overflows are now being implemented at great expense and have been decided based on imprecise computational models, with no attempt to illustrate to decision makers the uncertainties and marginality of the value of doing this. As a result, high energy and carbon in use and embodied in the construction are adding to the drivers of climate change.

Conclusions

"Given that engineers are… political actors…. the political and economic pressures that engineers work under have the potential to complicate ethical choices" (Hillier, 2010) expresses a view that professional engineers do have choices. Being a professional implies responsibility for conduct that extends beyond purely self-interest (and beyond the interests of the employer when necessary) and beyond the requirements of legislation or regulation (Fan, 2003). Ethics can be a positive force for innovation by inspiring a re-shaping of our environment through 'Value sensitive design' to meet conflicting demands and needs (van den Hoven et al, 2012).

In New Orleans, post-Katrina, the US Army Corps of Engineers are rebuilding the defences much as before the 2005 disaster as there are limited options available within the regulatory system (Jonkman et al, 2009). Such an approach is hardly an ethical or professional one and it is arguable that any professional in such a role is no longer a professional, but rather functioning as a technician (Schon, 1983). It is the duty of a professional to push the boundaries; to attempt what has not been tried before unless there is an unacceptable risk in a particular course of action. Even Ofwat is calling for greater innovation by the water and sewerage companies in England and Wales (Ofwat, 2012), although whether such innovation is envisaged as going beyond competition exhortations is doubtful. In any case Ofwat's approach to ethics falls into the accounting trap. There is an implicit presumption that where the WaSCs comply with the key indicators of performance then this de facto is an indication of ethical compliance in terms of the provision of water services (Cavill & Sohail, 2003).

Framing or habits of reasoning rooted in professional training, experience and in organizational histories often become established in organisations and the individuals that work in them (Laws & Loeber, 2011). These established frames (taken for granted common-sense) are often difficult to reflect on and they define what is normal, reasonable, feasible and justifiable in practice. Hence this makes it difficult for individuals to make sense of complex cases and the action required in the novel ways required to deliver sustainability or at least resilience. Given the multiplicity of other reasons for promoting schemes such as the Tideway Sewer Tunnels (increased asset value, capitalisation, profits to bank owners and lack of real financial risks) there is a difficult task for the professionals involved to promote what are self-evidently more beneficial solutions that are in fact opportunities to maximise the benefits from seeing the surface water 'problem' as very real 'opportunities'. Of course the use of SuDS, the associated costs and uncertainties, the disruption and finally the staged benefits of gradual implementation are all difficult to quantify (Ashley et al, 2010). But evidence from many other parts of the world shows that it does work and can bring major enhancements to the urban environment (Thurston, 2012).

Simple comparators of costs for the mono-problem solution, showing that conventional sewer storage is cheaper than the limited SuDS options investigated (Thames Water, 2011) fail to take into account the full range of additional benefits from the latter approach. These benefits will mainly accrue to society as a whole and will take at least 10-20 years to come about. A period during which the gradual introduction of SuDS can be tested and techniques improved. The latest expectation for completion of the tunnels follows a similar timescale and delivers no benefits during the period, only the disbenefits of construction disruption. Following such a course also commits society to using the tunnels in some 20 years time and beyond, when it may be prohibitively expensive or climate impacting to require such high energy use.

In recent ICE papers looking to the future, Rogers (2012) argues that civil engineers have “always addressed the core issues of sustainability, working for society within the environment to least cost or greatest value”. That may be true in an ideal view of civil engineering, however, recent evidence outlined in this paper for possible over-engineering and missing opportunities for making the most of using surface water for the wider benefit of society, suggest that there are many interpretations of ‘sustainability’ and what ‘greatest value’ may mean in practice. At a time of economic stringency it is inevitable that a number of professional engineers will find themselves working as technicians, unable to practice to the breadth and scope of their calling, and carrying out duties that lead to solutions to problems that are not as sustainable as they might be. A fear of upsetting employers or powerful clients by expressing doubts about the scope, direction and scale of a scheme also constrains any professional concerned about their own personal welfare and future (a moral dilemma); resulting in the placing of personal interests before society’s; an unethical stance but one in which the ICE or others are powerless to help. In a second paper, addressing the future of the ICE (Foulkes, 2012) describes the Institution as highly traditional and that radically new thinking is demanded to keep up with the demands of the competitive world; necessitating changes that many members will not be comfortable with. The new place for the Institution needs to be ‘credible, inspiring and sustainable’; a vision that requires a restatement of the ICEs’ ethical position and a grasping of the challenge laid down by Prince Charles to work with rather than controlling nature. In an increasingly demanding society, members and the Institution itself will need to be confident in their ethical and moral positions if they are to truly help society into a sustainable future.

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[1] Institution of Civil Engineers (Great Britain) (1870). Minutes of Proceedings of the Institution of Civil Engineers. The Institution. p. 215 note 1.

[2] In Europe, problem solving and creativity are presented as important competencies in the requirements for European Engineer (Eur. Ing.) designation (FEANI, 2000).