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level 4

Engineering Ethics: Maintaining society's trust in the engineering profession

A report by the Engineering Ethics Reference Group established
by the Royal Academy of Engineering and the Engineering Council

February 2022

Forewords

Professor Sir Jim McDonald CEng FEng FRSE **President, Royal Academy of Engineering**

I would like to thank Professor David Bogle FEng and his reference group for this important and timely report on ethics. The Engineering profession acts in the service of society.

We are therefore bound by a moral code of ethical behaviour – to act in a way that upholds the high standards expected by the public and to ensure that their safety is paramount – whether in designing bridges and skyscrapers, nuclear power stations, zero emission vehicles or AI technologies.

As this report shows, opinion surveys indicate that the engineering profession is generally respected by the public. But we cannot and must not be complacent. Ever higher expectations from society and new advances in technology require us to continually evaluate how ethical behaviours should improve and evolve over time.

This report and its proposed actions constitute an important step on the journey to ensure our profession achieves these aims.

Professor Chris Atkin CEng FRAeS FEng **Chair, Engineering Council**

I am very grateful to David and his colleagues for producing this report, underlining ethics as a key focus for the Engineering Council. I believe it our duty as a community of professional engineers and technicians to promote ethical practice to our colleagues, working across all sectors and disciplines.

A crucial step towards this is encouraging more of our colleagues to become professionally registered. Registered engineers and technicians are required to demonstrate a personal and professional commitment to society, to the environment and to their profession.

Registrants must demonstrate an understanding of ethical issues that may arise in their role and commit to carrying out their responsibilities in an ethical manner.

Registration also means committing to a Code of Conduct, adopting a set of values that maintains and enhances the reputation of the profession.

I hope that this report encourages all those in engineering to consider professional registration as a practical means of further embedding a culture of ethical behaviour among our community.



Executive summary

This report proposes actions and appropriate regulation that will achieve a more ethical culture in the UK's engineering profession. At its heart is the need to ensure that the public has confidence that the profession acts ethically.

The report proposes a series of actions for the engineering profession to take forward with the aim of promoting an ethical culture within the engineering profession. The actions have been grouped into five themes: Leadership and Accountability, Education and Training, Professionalism, Engagement and Communication, and Governance and Measurement. A new governance framework is proposed to manage this process.

It has been agreed that a greater focus on ethics during the development and progression of engineers and engineering technicians should be overseen by educators, employers and Professional Engineering Institutions (PEIs) together.

The measures proposed in the report will increase awareness of ethical issues within the profession and aim to improve engineers' ability to deal with, and call out, bad practice.

Such a focus now will enable the engineering profession to maximise its contribution to the many challenges that confront society, particularly around sustainability and climate change.



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Ethics builds trust

We like to think of engineering as a profession that demonstrates ethical behaviour in its decision-making, from the very technical level to the strategic. Inevitably, there are tensions between profitability, sustainability and safety that engineers seek to be aware of and need to balance. We know that professional engineers and technicians endeavour to get things right. However, there have been some important questions posed in recent years and social media has amplified that public scrutiny.

For example Boeing 737 MAX aeroplane crashes were caused by “Technical design flaws, faulty assumptions about pilot responses and management failures ... played instrumental and causative roles in the chain of errors”¹. In the review of Building Regulations conducted by Dame Judith Hackitt DBE FREng following the Grenfell Tower tragedy, it was highlighted that there was a “cultural issue across the [construction] sector, which can be described as a ‘race to the bottom’ caused either through ignorance, indifference, or because the system does not facilitate good practice.”² The final report in response to Dame Judith’s review, *Setting the Bar*,³ has highlighted the need for improvement in the construction industry.

Engineering professionals make decisions that affect society all the time, from small-scale technical choices that will influence safety and the local environment to major strategic decisions that can affect the lives of millions and ultimately the future of the planet. The development of engineers and technicians will always include a strong focus on technical competence. However, while ethical issues are increasingly being discussed during education and training, there is scope for more discussion about judgements, ethical decision-making, dealing with uncertainty and how engineers engage with society.

As well as the high-profile engineering decisions that have undergone major public scrutiny, there are many other examples of issues that require monitoring and ethical decision making, including:



- a. The use, until recently, of crash test dummies that have been designed to represent male drivers, leaving women at greater risk in car accidents.
- b. The potential for algorithms and internet search engines to influence our thoughts on the world, sometimes to the detriment of others, for example by embedding structural inequalities.
- c. Issues arising from the testing of facial recognition technology with mostly white male images and the extent of the designer’s/coder’s responsibility for technology bias.
- d. The use of artificial intelligence to develop medical imagery diagnosis.
- e. The use of autonomous systems that will make safety critical decisions such as those being developed for autonomous vehicles.

In 2002 and 2003, Professor John Uff CBE QC FREng explored the legal implications of ethical aspects of engineering decisions in a series of articles in the Academy’s quarterly magazine *Ingenia*⁴. This prompted the development of the first version of the *Statement of Ethical Principles*, issued jointly by the Engineering Council and the Royal Academy of Engineering⁵. This was updated in 2017. These publications prompted greater awareness of the role of the whistleblower and the need for protection. In 2011, Richard Maudslay CBE FREng and Dr Natasha McCarthy led the team that produced

¹ The US House Transportation and Infrastructure Committee final report: The design, development & certification of the Boeing 737 Max. <https://transportation.house.gov/imo/media/doc/2020.09.15%20FINAL%20737%20MAX%20Report%20for%20Public%20Release.pdf>

² ‘Building a Safer Future – Independent Review of Building Regulations and Fire Safety’ by Dame Judith Hackitt presented to Parliament by the Secretary of State for Housing, Communities and Local Government, May 2018.

³ Setting the Bar A new competence regime for building a safer future. <https://cic.org.uk/admin/resources/setting-the-bar-9-final-1.pdf> Produced by an industry Steering Group in response to Dame Judith Hackitt’s post-Grenfell Tower fire review. <https://cic.org.uk/admin/resources/setting-the-bar-9-final-1.pdf>

⁴ Uff J. (2002–03) Engineering ethics *Ingenia* issues 13, 14 and 15 <https://www.ingenia.org.uk/>

⁵ www.engc.org.uk/ethics

a case study guide entitled *Engineering Ethics in Practice*, published by the Royal Academy of Engineering. The publication's aim was to encourage engineers and engineering technicians to think about ethics.

In a keynote speech to the Engineering Ethics Conference in 2018, Professor Chris Atkin FREng CEng, Chair of the Engineering Council, suggested that the engineering profession needed to “seek to create habit, custom and indeed culture” when considering engineering ethics. He said that an analogy could be made with the now-accepted centrality of health and safety considerations in engineering decision-making. Embedding ethical culture and practice in the engineering profession would embrace other important professional behaviours such as operating sustainably, inclusively and with respect for diverse views. Greater visibility of an ethical engineering culture by the whole of society would help ensure that engineers and engineering technicians retain society's trust.

It is essential that the engineering profession achieves a similar step change in ethical decision-making to that achieved over the past 30 years with issues concerning health and safety, building a culture of continuous improvement. Properly addressing the health and safety aspects of engineering, be it design, operation, maintenance or end-of-life decommissioning, is now a cornerstone of engineering practice. These changes came about through a combination of legislation to set rules and training that serve to shape positive behaviours.

Today, sustainability is now being more actively addressed by engineers, owing to the greater awareness of the climate emergency, particularly by younger generations who will reap the consequences of inaction. Inclusivity now has a much higher profile because of the convincing narrative of both the benefits of inclusive recruitment and the retention of talent.



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Context

Which of these approaches are replicable for embedding an ethical engineering culture? What are the convincing benefits for engineering employers and individuals? What is the right balance of regulation?

This report proposes actions that balance the reinforcement of benefit for all while seeking appropriate regulation that will achieve a more ethical culture within the UK engineering profession.

Operating under its Royal Charter, the Engineering Council works to ensure that society continues to have confidence and trust in the engineering profession. However, regulation of ethical conduct is far more nuanced than enforcement of standards or legislation, and involves a collaborative effort across the profession.

A key goal of the Royal Academy of Engineering is to 'harness the power of engineering to build a sustainable and inclusive economy that works for everyone'. This means ensuring that an engineering viewpoint should be part of key decisions affecting our way of life; for example in influencing decision-making about matters such as climate, infrastructure, and healthcare.

In June 2019, the Engineering Council and the Royal Academy of Engineering established a joint Engineering Ethics Reference Group (EERG, see **Annex 1**) chaired by Professor David Bogle FICHEM FREng. The EERG has a strategic level remit, with a leadership and advisory role, to shape the profession's ethics-related activity and to steer an enhanced culture of ethical behaviour among those working in engineering. In taking this responsibility towards ethics as seriously as it does, it plays a key part in the profession continuing to be self-regulating, a position which it values and respects.

This report sets out the context and issues discussed by the EERG informed by consultation within the Royal Academy of Engineering, the Engineering Council and the Professional Engineering Institutions (PEIs) and makes recommendations for action under five key themes.

At its heart is the need to ensure that the public has confidence that the profession acts ethically: *'Engineering professionals work to enhance the wellbeing of society. In doing so they are required to maintain and promote high ethical standards and challenge unethical behaviour.'* (Statement of Ethical Principles 2017, Engineering Council/Royal Academy of Engineering)

Current position, instruments and resources

The engineering profession has been, and continues to be, active in the area of engineering ethics, aiming to support practising engineers and technicians, inform debate and protect the public.

As regulator for the profession, the Engineering Council is responsible for setting the standards of competence that must be demonstrated by those seeking registered status. Demonstration of *ethical behaviour* is specifically mentioned for all categories of registrant⁶. It also publishes guidance for individual engineers and technicians, makes requirements for ethics within its criteria for accredited degree and approved apprenticeship status, and requires inclusion of ethical behaviour in the codes of conduct of each of the 40 PEIs. While only enforceable for registrants, its ethical principles are designed to inform all engineering practice in the UK. All these standards and documents are periodically reviewed to ensure currency, relevance and value.

Through events, publications and teaching resources, the Royal Academy of Engineering seeks to enrich thinking about engineering ethics across the whole profession and provide materials and inspiration for practitioners about the wider impact of their work. The Academy's work on ethics includes ethics in engineering education, ethics in practice and the issues surrounding emerging engineered technologies.

There is therefore a solid basis on which to build. Of particular note are the 2017 revision of the

Statement of Ethical Principles, which intentionally broadened its reach to include non-registrants⁷, the Engineering Council's *Guidance on Whistleblowing for engineers and technicians* (2015), the recently strengthened CPD requirements for registered engineers and technicians, and the initiative of some PEIs to encourage companies to sign pledges – for example the IET's concordat on 'Ethics and Professionalism'⁸. Several PEIs have also encouraged employers to pledge to a 'Declaration on the climate and biodiversity emergency'. **Annex 2** provides a summary of some key documents.

However, the engineering profession is not complacent and is keen to keep abreast of the wide range of emerging issues noted above. Potential approaches to deal with these include:

- Improve the profession's visibility on ethical guidance and practice
- Engage and lead the whole profession not just those registered in Professional Engineering Institutions
- Enhance engagement with employers: provide leadership to smaller companies, perhaps via their supply chains, and engage at Board level with larger companies to assist them to navigate the range of standards/codes/guidance.
- Ensure alignment between ethical behavior and the profession's requirements, processes and mechanisms for calling out poor ethical practice (whistleblowing).
- Drive the debate within society so that engineers feature more in public enquiries, contribute more press articles, and are turned to for advice.



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⁶ www.engc.org.uk/standards

⁷ Registrants of professional engineering institutions comprise 229,000 practising engineers and technicians; the engineering workforce total is estimated to be nearer to 5 million.

⁸ <https://www.theiet.org/involved/partnerships/iet-concordat/>

Public perception of engineers and engineering practice

The 2021 Ipsos MORI Veracity Index indicates that engineers are trusted to tell the truth by a significant 84% of the population, making it the sixth most trusted profession in the UK, closely following doctors and teachers. The Ipsos MORI survey has tracked trust in the key professions since the 1980s and 2018 was the first explicit inclusion of engineering⁹.

The *Independent Review of Building Regulations and Fire Safety* also acknowledged the profession's *Statement of Ethical Principles*. The review group, which extended beyond the engineering profession, concluded that there was no need to create something new or separate but suggested that more exemplars would help.

Along with the instruments summarised in **Annex 2**, there is a good basis on which to build some of these approaches, thereby enhancing the profession's visibility on ethics while engaging, promoting, and driving the debate within society.

Several earlier studies, including the Royal Academy of Engineering's *Public Attitudes to, and Perceptions of, Engineering and Engineers* (2007), showed that despite limited public awareness and knowledge about engineering, the profession itself was viewed positively, especially when compared with other professions.

This limited awareness of engineers and engineering, and therefore, by extension, the capacity to engender trust, has also been reported internationally, for example by Engineers Canada. Its 2015 report also cited a low familiarity about engineers.

However, 82% of its respondents who were familiar with engineers also held a favourable overall impression of the profession – although trust scored lower (59%) than respect (71%)¹⁰. The Structural Engineers Association of California cites a lack of recognition of engineers' contributions to major projects, especially architectural ones¹¹.

Corporate awareness and perception

In his keynote to the 2018 Engineering Ethics conference, Professor Chris Atkin FEng stressed that any aspiration to create an ethical culture must be matched with a commitment by individual engineers, supported by their employers.

Given the tensions between commercial and ethical imperatives, and the likelihood of a lower ethical awareness in early-career professionals, the key players in this commitment are employers.

Stronger messages from a larger number of employers, emphasising the importance of registration, would transform the power of the Engineering Council and the PEIs to deliver an enhanced and embedded ethical culture.

There are many examples of companies taking this matter seriously and a few are cited in **Annex 2**. However, this list is not exhaustive and more needs to be done, especially with respect to SMEs, which are harder to reach.



⁹ https://www.ipsos.com/sites/default/files/ct/news/documents/2021-12/trust-in-professions-veracity-index-2021-ipsos-mori_0.pdf

¹⁰ <https://engineerscanada.ca/sites/default/files/public-perceptions-of-engineers-and-engineering.pdf>.

¹¹ www.seaoc.org/news/407282/The-Public-Perception-of-the-Engineer.htm

Engineer and technician awareness

The Engineering Council introduced one new standard into its 2014 revised registration standards for all engineers: *'Exercise responsibilities in an ethical manner'*. This was complemented by signposting to the *Statement of Ethical Principles*. The Engineering Council's 2020 periodic revision of its standards led to a strengthening to: *'Understand the ethical issues that may arise in their role and carry out their responsibilities in an ethical manner.'* This broadens the competence to include an emphasis on understanding potential issues that *might* arise in a role. It follows that awareness among recent and future registrants is expected to be higher.

The *Statement of Ethical Principles* is highly valued by the PEIs. Several PEIs produce ethics-related materials such as training and webinars. However, these tend to be member-only resources though a few are more widely accessible and some are free. The Royal Academy of Engineering's case studies are aimed partly at the higher education sector for use with students but will still have relevance throughout engineers' careers.

To our knowledge, how an individual student, apprentice, graduate, engineer or technician turns 'awareness' into action has not been researched. Nor have other important considerations such as how an individual decides on a course of action, what leads to unethical action, the reporting of incidents including whistleblowing, and the role for so-called 'mavericks' who forecast potential catastrophes way ahead of their time.

What 'GOOD' would look like for the UK engineering profession

EERG recommends the following Vision:

UK engineering ethics principles and practice is regarded nationally and internationally as world class, with ethics embedded in its culture such that society can maintain confidence and trust in the engineering profession.

This draws on the four pillars contained within the *Statement of Ethical Principles*, first published in 2005 by the Engineering Council and the Royal Academy of Engineering, reviewed and updated in 2017. These state that all those in the engineering profession act with:

- honesty and integrity
- respect for life, law, the environment and public good
- accuracy and rigour
- leadership and communication.

To realise this vision, the UK engineering profession must integrate and embed a professional ethical culture throughout via targeted engagement of engineers and technicians, engineering employers, engineering education and training providers and the wider public to maintain society's confidence and trust in the profession. The role of the leaders of the profession is to enable this to happen.

The fulfilment of this vision will never be complete as ethics is a constantly evolving matter. To maintain the trust of society the engineering profession will need



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to continually reflect, revise and enhance its codes, training and supervision. Society's expectations of professionals constantly change, along with other drivers such as the approach to diversity and inclusion. The profession values its self-regulation so regular internal reflection is needed, sometimes with added independent scrutiny.

What will be the results of achieving this goal?

- Public trust in, and awareness of, the engineering profession remains high.
- The UK is recognised internationally as having high ethical standards in engineering.

Some of the implications would be that:

- All apprentices and students will understand how to explore ethical decision making.
- All practising engineers and technicians will receive regular training to increase their awareness of potential ethical issues and help them take ethical decisions.
- All engineering professionals will have a good understanding of how to take ethical principles through to engineering standards and practice.
- Everyone in the profession will feel empowered to raise concerns and challenge decisions.
- All engineering employers would adopt the *Statement of Ethical Principles*.
- Decision-making will be open, transparent and accountable, taking into account a diversity of views – unless there are defensible reasons such as commercial or national security concerns.
- Public understanding of the centrality of ethics in the engineering profession is enhanced.

How we get there

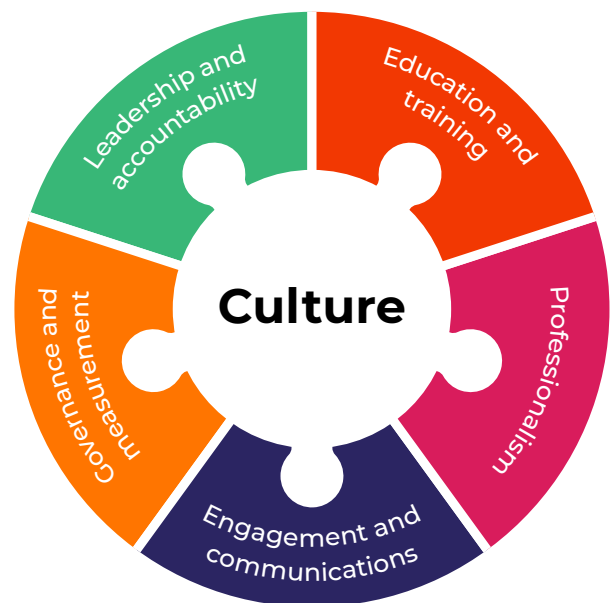
Realising this goal will require collaborative action and shared responsibility – this will not be limited to the Engineering Council, the PEIs and the Royal Academy of Engineering. However, the Engineering Council and the Academy will have a key role in leading and facilitating the development of the strategy to achieve the Vision and in ensuring that there is consistency across the engineering profession.

Suggested stakeholder groups are listed in **Annex 3**. These stakeholders need to be considered and included. 'Landscape mapping' to identify other stakeholders will be key to ensuring a fully collaborative approach.

The profession already has a strong basis on which to build: its package of existing processes, requirements and activities and, crucially, the commitment from the CEOs of the PEIs to drive this agenda forward.

There are five themes to the suggested actions, all drawn from feedback from the profession, all aiming to foster a culture of ethical debate and accountability. They will increase awareness of ethical issues within the engineering profession and improve engineers' ability to both deal with, and call out, bad practice.

- Leadership and Accountability
- Education and Training
- Professionalism
- Engagement and Communications
- Governance and Measurement



In this context, we view Leadership as encouraging behaviours that can be practised across all levels of the engineering profession, not just by senior members. Professionalism refers to embedding ethical practice in engineers' work while Education and Training refers to the formal elements of preparation and continual development of ethical practice. Engagement actions aim to enhance communications with wider society. Governance actions are for the profession to oversee and drive the UK engineering profession's progress on ethical behaviour.

Broad areas for action are described below under the five themes. EERC's recommended priority actions are denoted as 'short-term'. The areas for action are all important; they are not intended as sequential. Some of these will most likely happen in parallel and some will build on what is already happening. The summary on page 12 shows the actions in terms of short, medium and longer-term for discussion by stakeholders. This will require considerable resources and commitment by the engineering profession and its representative bodies.

Broad areas for action	Actions (<i>some of these build on existing practices while some are new</i>)
<p>Leadership and Accountability</p> <p>Maintain position and recognition as leaders in driving ethical standards and practice forwards across the engineering profession.</p>	<p>Short term actions</p> <ul style="list-style-type: none"> ■ Create a progression framework for ethical practice. ■ Develop ethics toolkits for leaders (at all levels) to help them embed ethics into culture (building on the work of the educational working group on other toolkits). <p>Medium term actions</p> <ul style="list-style-type: none"> ■ Review and where necessary enhance (longer term) the sanction procedures for poor ethical practice. ■ Review the support available for those calling out poor practice (whistleblowing guidance). ■ Share how ethical behaviours in leadership are encouraged within other professions. <p>Longer term actions</p> <ul style="list-style-type: none"> ■ Establish a peer support network for engineering executives and leaders at all levels. ■ Establish fora for exchanging good practice in driving behaviour. ■ Establish a system for reporting ethical mishaps. ■ Review the value of wider regulation of specific functions by different agencies and how it relates to regulation of title.
<p>Education and Training</p> <p>Support and maintain a consistent and coherent approach (HE/FE/CPD) to improve the quality of how ethics is understood by those in the engineering profession.</p>	<p>Short term actions</p> <ul style="list-style-type: none"> ■ Continue to review the RAEng Engineering Ethics in Practice case studies (2011) and gather data on their use and value ■ Undertake an audit of ethics teaching and training in HE/FE/ apprenticeship providers, establishing what new resources would be welcome <p>Medium term actions</p> <ul style="list-style-type: none"> ■ Establish educational working group(s) to: <ul style="list-style-type: none"> – Create ethics toolkits and case studies to support educational programmes and CPD, – Develop training programmes for educators, trainers and managers. <p>Longer term actions</p> <ul style="list-style-type: none"> ■ Explore both the requirement for and potential support for engineering ethics in primary and secondary education
<p>Professionalism</p> <p>Engagement with the profession to maximise adoption of professional values, ethics and practice 'Think ethics before action'.</p> <p>Maximise the number of professionally registered individuals in the engineering community to uphold ethical practice and increase the accountability of individuals against ethical standards.</p>	<p>Short term actions</p> <ul style="list-style-type: none"> ■ Strengthen the role of ethics as a clear value proposition for professional registration as a signal of professional commitment. ■ Explore the development of a PEI Concordat on Engineering Ethics derived from the ethics progression framework. <p>Medium term actions</p> <ul style="list-style-type: none"> ■ Explore strengthening ethics-related CPD requirements ■ Establish a pan-profession group to: <ul style="list-style-type: none"> – Facilitate and promote the sharing of good practice on ethics between PEIs, – Establish peer support networks for engineers and technicians, – Establish peer support networks for new entrants, – Carry out periodic reviews of the <i>Statement of Ethical Principles</i> and supporting materials as and when deemed necessary. ■ Explore the potential development of an engineering equivalent to the medical Hippocratic Oath

Broad areas for action	Actions (<i>some of these build on existing practices while some are new</i>)
<p>Engagement and Communications</p> <p>Maximise engagement with society and industry to foster public awareness. Stress the centrality of ethics to the engineering profession, promoting debate and learn how this may influence our ethical responsibilities.</p>	<p>Short term actions</p> <ul style="list-style-type: none"> ■ Develop an initial communications plan. ■ Promote the <i>Statement of Ethical Principles</i> within engineering and raise awareness of it externally. <p>Medium term actions</p> <ul style="list-style-type: none"> ■ Develop a public engagement campaign that strengthens and broadens debate (thereby contributing to the profession's policy making) among: <ul style="list-style-type: none"> – Engineers – Public – Executives and leaders – New entrants to the profession. <p>Longer term actions</p> <ul style="list-style-type: none"> ■ Establish a fact checking system for the media about ethical issues and engineering – this should link to the National Engineering Policy Centre (NEPC).
<p>Governance and measurement</p> <p>Understanding ethical culture in the engineering profession, benchmarking against, and learning from other professions and setting targets for future improvements.</p> <p>Developing tools and guidance for future improvements.</p>	<p>Short term actions</p> <ul style="list-style-type: none"> ■ Propose and agree governance measures for work on ethics. ■ Establish an audit and evaluation group. <p>Medium term actions</p> <ul style="list-style-type: none"> ■ Define the features of a leading profession in ethical matters including: benchmarking against other professions, and exploring the inclusion of ethical performance in business reporting. ■ Work of the audit and evaluation working group: <ul style="list-style-type: none"> – To produce an Audit and Evaluation report on the state of engineering ethics which includes ways to measure the profession's performance against the Vision. – To create a process using the progression framework for ethical practice that includes benchmarking and determines where ethics could form part of business reporting.



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Challenges

The EERG also identified some challenges that make these actions difficult or raise unresolved issues. We see these as fitting into two categories: 'practical' or 'unresolved'.

Practical challenges

- Identifying common ground and managing differences between disciplines and those involved in engineering decision-making but without engineering training.
- Achieving influence when only a small percentage of UK engineering professionals are registrants.
- Other stakeholders such as insurers may have differing ethical requirements.
- Issues are often complex and conflicting, making them difficult to explain to the media and society.
- Rapid evolution of technology and its effect on job security such as artificial intelligence and computational developments.
- Some countries may have higher or lower standards.

Unresolved challenges

- Identifying where responsibility lies: with an individual, a collective, an organisation or company, so that regulation is appropriately targeted.
- Lack of diversity in the profession reduces the range of voices and opinions in engineering ethics debates. However, work on diversity and inclusion in the profession is underway.
- Identifying and defining the relationships between legal measures, professional sanctions, employer responsibility and leadership.

The way forward

The Royal Academy of Engineering and the Engineering Council have agreed to take forward these actions with the support of the PEIs. A Governance Framework has been agreed and is in operation.

A Steering Board has been established and a Co-ordination Group set up to take forward the actions in this report. The Coordination Group will be the pan-profession 'doing/action-oriented body' comprising nominees from PEIs, Engineering Council and Royal Academy of Engineering.

The EERG will continue to consider broader, changing influences on engineering ethics, from technological and societal changes for example, in order to advise the Steering Board.

The role of engineers is key to society's prosperity, well-being and sustainability. Engineers must fully engage to take their place in the decision-making when engineering principles are important. To do this, the engineering profession must retain the trust of society.

A greater focus on ethics in the development of engineers and technicians and their progression overseen by educators, employers and PEIs is crucial for the engineering profession to make its full contribution. We believe the following roadmap will help us achieve this.

We encourage all engineering organisations and employers to consider what they should be doing to embed ethical thinking more strongly in all that we do.



Potential roadmap



Short term	Medium term	Long term
Create a progression framework for ethical practice	Review of support for those calling out poor practice (whistleblowing guidance)	
Develop ethics toolkits to for leaders on embedding ethics into culture	Review and where necessary enhance sanctioning for poor ethical practice	
	Share ethical behaviours in other professions	Establish a system for reporting mishaps
		Establish fora for exchanging good practice in driving ethical behaviour
		Establish peer support networks for engineering executives and leaders
Review use of RAEng ethical case studies (2011), gather data on use/value	Establish working groups (toolkits, case studies, training programmes)	Explore requirement for/ potential for ethics in primary and secondary education
Audit of ethics teaching and training in HE/FE/Apprenticeship programmes, ascertain resource requirements	Support use of case studies and update as required	
Strengthen role of ethics for professional registration signalling commitment	Explore strengthening ethics-related CPD requirements	
Explore development of PEI Concordat on engineering ethics derived from ethics progression framework	Establish peer support networks for new entrants to profession (pan profession group PPG)	
	Periodic review of Statement of Ethical Principles + supporting materials (PPG)	
	Facilitate and promote sharing of good practice between PEIs (PPG)	
	Explore ways to engage and show commitment to ethics e.g. development of 'Hippocratic Oath' (PPG)	
	Establish peer support networks for engineers and technicians (PPG)	
Promote Statement of Ethical Principles within engineering, raise awareness externally		
Develop initial communications and marketing plan	Public engagement plan	Establish fact checking system for media about ethical issues and engineering
Establish an audit and evaluation group	Working group produces audit and evaluation report of state of engineering ethics, creates process for measuring ethical practice using progression framework for ethical practice which includes benchmarking and whether ethics could form part of business reporting.	
Agree governance measures for work on ethics	Define the features of leading profession in ethical matters (including benchmarking against other professions, ensuring inclusion of ethical performance in business reporting)	

Annex 1

Engineering Ethics Reference Group Report EERG Membership

Professor David Bogle FIChemE FREng (Chair)

Pro-Vice-Provost of the Doctoral School University College London
Deputy President of the Institution of Chemical Engineers

Philip Corp CB CEng HonFSOE FIMEche

Privy Council and Governance Panel, Engineering Council
(Stepped down Feb 2020)

Katie Cresswell-Maynard

Chief Executive, Engineers Without Borders UK
(until December 2020)

Emma Crichton CEng MICE

Head of Engineering, Engineers Without Borders UK
(from December 2020)

EUR ING Bill Hewlett CEng FICE FIET

Technical Director, Costain
Engineering Council Trustee
(Stepped down Feb 2020)

Professor Kevin Jones CEng CITP CSci FIET FBCS

Executive Dean, Faculty of Science and Engineering, Plymouth University
Engineering Council Trustee

Richard Maudslay CBE FREng

Member of the Advisory Board of Marble Arch Partners LLC

Dr Natasha McCarthy

Head of Policy - Data, The Royal Society

Jo Parker MBE CEng FIWater MICE

From June 2021
Engineering Council Trustee

Professor Raffaella Ocone FREng FRSE FIChemE FRSC

Chair of Chemical Engineering, School of Engineering and Physical Sciences
Heriot-Watt University

Mike Rose CEng MIMarEST

From May 2020 - March 2021
Engineering Council Trustee

David Short CEng FRAeS MIET

Technology Director, BAE Systems
Engineering Council Trustee

Professor Jean Venables CBE FREng CEng CEnv FICE

Director, Venables Consultancy
(Stepped down June 2021)

Staff - Engineering Council

Deborah Seddon

Regulatory Affairs Manager (Secretariat)

Michael Curran

Committee and Support Executive

Rebecca Charikar

Committee and Project Support Executive

Paul Bailey

Deputy Chief Executive/Operations Director

Staff - Royal Academy of Engineering

Dr Rhys Morgan

Director of Engineering and Education

Claire Donovan

Senior Profession Relationship Manager

Annex 2

Current position, instruments and resources

Statement of Ethical Principles (2017) Engineering Council and Royal Academy of Engineering
www.engc.org.uk/ethics

Requirements for registration (UK-SPEC and Standard for ICT Tech)
www.engc.org.uk/standards

Standards for Ethical Conduct in UK Engineering, Professor Chris Atkin FREng CEng
Keynote presentation, Engineering Ethics Conference 6 September 2018, University of Leeds
Accessed via <https://ahc.leeds.ac.uk/enethics2028/doc/engineering-ethics-conference-2018-programme/>

Guidance on Whistleblowing (2015) Engineering Council
www.engc.org.uk/whistleblowing

Guidance for institution codes of professional conduct (2017) Engineering Council
www.engc.org.uk/engcdocuments/internet/website/Guidance%20for%20Institution%20Codes%20of%20Conduct%202017.pdf

Ethics Curriculum Map (undated) Royal Academy of Engineering
www.raeng.org.uk/RAE/media/General/News/Documents/Ethics-Curriculum-Map.pdf

Engineering ethics in practice: a guide for engineers (2011) Royal Academy of Engineering
www.raeng.org.uk/publications/other/engineering-ethics-in-practice-full

Accessible/public resources produced by individual PEIs:
Institution of Civil Engineering SayNo Toolkit.
www.ice.org.uk/knowledge-and-resources/best-practice/civil-engineering-ethics-toolkit

Declaration on the climate and biodiversity emergency issued by several PEIs, for example
www.istructe.org/structural-engineers-declare/

Exemplar materials from companies

BP

Our Code, Our Responsibility
<https://tinyurl.com/h4ed74e6>

Costain

Primary control is from:

- Company values are clear and make ethical expectations clear; they are well communicated and embedded – see www.costain.com
- Professional qualification is the expectation for most responsible and all leadership positions; professional qualification brings with it commitment to ethical principles (in many cases to the Engineering Council and Royal Academy's Statement of Ethical Principles).

These are complemented by:
Ethical Business Conduct Policy
Responsible Business Policy

Rolls Royce

At our best: our Code
<https://ourcode.rolls-royce.com/>

Annex 3

Suggested stakeholder groups

1. The professional engineering community:

- a. Engineering Council/Royal Academy of Engineering boards
- b. PEIs (40) and professional affiliates (18)
- c. Their members.

2. Workplace:

- a. Registrant engineers and technicians
- b. Non-registrants working in engineering
- c. New entrants to the engineering workplace/the profession – for example via the EWB
- d. Corporates: larger companies to reach smaller companies via supply chains
- e. SMEs – for example via Make UK
- f. Entrepreneurs, startups, NGOs
- g. Corporate signatories to ‘concordats’ such as IET’s President’s Concordat which includes a commitment to ethical practice
- h. Board level in larger companies – to assist them in navigating the range of standards/codes/guidance
- i. Employer organisations such as Make UK, the Institute of Business Ethics, CBI
- j. Trades Unions.

3. HE/FE: Students, trainees and the providers of their education and training.

4. Policy shapers/makers

- a. Links between the profession and government departments – for example: Department for Transport, BEIS, Department for Levelling Up, Housing and Communities, their policy makers/other non-departmental bodies such as the National Infrastructure Commission
- b. National Engineering Policy Centre (NEPC) – coordinated by Royal Academy of Engineering.

5. Researchers

- a. UKRI and similar bodies
- b. Inter-Disciplinary Ethics Applied Centre, University of Leeds
- c. Jubilee Centre for Character and Virtues, University of Birmingham – research into virtues in professions www.jubileecentre.ac.uk/1595/projects/published-research/virtues-in-the-professions
- d. Professional Associations Research Network (PARN).

6. Other professions

- a. The City and/or the business sector
- b. Law, medicine, accountancy, architecture
- c. Cyber security profession via Cyber Security Council launched April 2021 <https://www.ukcybersecuritycouncil.org.uk/>.

7. The public/society – ‘two directional’

- a. Engaging/promoting/driving the debate with society
- b. Increasing our awareness of the public perception of engineering/how this may influence our ethical responsibilities.



Royal Academy of Engineering

The Royal Academy of Engineering is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.



Engineering Council

The Engineering Council holds the national Register of Engineering Technicians (EngTech), Incorporated Engineers (IEng), Chartered Engineers (CEng) and Information and Communication Technology Technicians (ICTTech).

It also sets and maintains the internationally recognised standards of competence and ethics that govern the award and retention of these titles.

By this means it is able to ensure that employers, government and wider society, both at home and overseas, can have confidence in the skills and commitment of registrants. For more information visit: www.engc.org.uk