ENGINEERS EUROPE

Subject: Advice Note to the Engineering Community in an era of AI

In 2025 ENGINEERS EUROPE (EE) set up a working group (WG) on AI, following the expressed interest in the topic at the National Member Forum back in 2024. The WG finalized the attached "Advice Note" to which the following members contributed :

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AI is transforming engineering practice by accelerating documentation, analysis, and communication, freeing engineers to spend more time on design thinking, problem-solving and decision-making.

AI systems can strengthen engineering judgement, but they must be applied with transparency, verification and a clear understanding of their limitations. In this paper we go through how AI is shaping engineering practice, where it adds value, what responsibilities it introduces, and how its use can be effectively governed. The ultimate message is that engineers retain responsibility for the final decision and must ensure that AI-assisted outcomes meet the same ethical and safety standards expected of traditional engineering practice.

The goal of this paper is not to discourage AI adoption, but to ensure it is used in a way that maintains competence, protects the public and preserves trust in engineering outcomes.

A case study is also being presented to showcase the importance of guidance and education in AI.

AI in Engineering

Artificial intelligence has evolved from early rule-based systems in the mid-20th century, to expert systems in the 1980s, and the rapid growth of machine learning in the 2000s, into data-driven models capable of supporting a wide range of engineering tasks. Recent developments, particularly in machine learning and Large Language Models (LLMs), enable systems to generate, summarise, and interpret information in ways that can assist engineers in their day-to-day work.

These tools can support activities such as drafting reports, structuring inspection records, summarising analysis results, and navigating large volumes of technical documentation. They can also help bridge knowledge gaps by making standards, vendor information, and prior project data more accessible. Used appropriately, this can reduce time spent on routine tasks and allow engineers to focus more on design, evaluation, and decision-making.

At the same time, AI systems differ from traditional engineering tools in important ways. Many are probabilistic rather than deterministic, and their outputs may appear plausible while containing inaccuracies, omissions, or unsupported assumptions. Their performance depends on the quality of input data, the context in which they are used, and inherent limitations that are not always visible to the user. For this reason, AI outputs should be treated as preliminary inputs requiring verification, not as authoritative results. As with any engineering tool, effective use of AI depends on understanding both its capabilities and its limits. This includes awareness of common failure modes, such as confident but incorrect responses, sensitivity to incomplete inputs, and difficulty in assessing the reliability of generated content without independent checks.

Professional duty & accountability

Within the ENGINEERS EUROPE community, it is recognised that in many European countries, engineers are granted the authority to certify, approve, or sign off on work within their area of competence. This responsibility is personal and cannot be delegated to tools or systems, and the use of AI does not alter this position. Responsibility for the accuracy, safety, and suitability of engineering work remains with the engineer. Engineers should only approve work that they understand sufficiently and can justify based on established engineering principles, evidence, and standards. Outputs generated with the assistance of AI should therefore be treated in the same way as any other external input, they must be reviewed, checked, and, where necessary, independently verified. The presence of AI in the workflow does not reduce the level of scrutiny required, nor does it transfer liability. Maintaining competence is also essential. Engineers using AI tools should have a working understanding of how such tools operate, including their typical strengths, limitations, and areas of uncertainty, so that outputs can be assessed appropriately.

Controls in practice:

Consistent with established engineering practice and reflected in discussions within ENGINEERS EUROPE, the use of AI is best managed through a risk-based approach. The level of control applied should be proportionate to the potential impact of the AI-assisted task on safety, compliance, cost, and public trust.

A tiered approach can provide a practical framework:

- *Low-risk applications*: Uses such as improving clarity, formatting text, or summarising non-critical information. <u>Controls</u>: Basic review for accuracy and appropriateness.
- *Medium-risk applications*: Uses such as drafting technical summaries, supporting preliminary analysis, or organising project information.
  <u>Controls</u>: Review by a competent engineer, with cross-checking against known data, calculations, or standards.
- *High-risk applications*: Uses that influence design decisions, safety-critical elements, regulatory compliance, or formal sign-off. <u>Controls</u>: Formal verification and validation, clear traceability to source data and assumptions, and independent review in line with existing quality assurance processes.

Implementation in practice:

The integration of AI into engineering workflows can build on existing governance and quality management systems. In practice, organisations and teams should:

- Ensure traceability, linking AI-assisted outputs to source data, calculations, drawings, and applicable standards.

- Verify and validate outputs, distinguishing between checking correctness (verification) and confirming suitability for purpose (validation).

- Document the use of AI, particularly where it influences technical decisions or deliverables.

- Develop AI literacy so that engineers understand typical behaviours, limitations, and failure modes.

- Protect confidential and sensitive information, ensuring that the use of AI tools complies with data protection requirements and contractual obligations.

- Monitor performance over time, recording issues, learning from experience, and updating controls as needed.

AI tools should be treated in a manner consistent with other engineering tools, they require appropriate selection, controlled use, and ongoing evaluation.

Conclusion:

This advice reflects the shared view within ENGINEERS EUROPE that AI offers clear opportunities to improve efficiency, access to information, and the quality of engineering workflows, while also introducing new considerations that must be actively managed. Its value lies in supporting, not replacing, professional judgement. By applying established principles of engineering practice, competence, accountability, verification, and risk management, engineers can make effective use of AI while maintaining the standards of safety, reliability, and public trust that underpin the profession.

References and further information:

As highlighted in the introduction, there are numerous papers and useful information being issued. The AI WG encourages ENGINEERS EUROPE members to keep updated. Some of the papers and information are linked here for informational purposes:

The EU Artificial Intelligence Act (https://artificialintelligenceact.eu/the-act/).

The Future of Privacy Forum Resources on the EU AI Act (link to website here)

The Royal Academy of Engineering (UK) AI campaign on safe and ethical AI development (here).

Engineering New Zealand's 4-page AI Policy for assessment documentation (here).

The Evolution of Machine Learning: A Journey from Early Concepts to Modern Applications (link to website here).

Case study:

Dublin City University (Academia)
Title: Teaching nuanced usage of gen AI

Background: By aiming to empower students to experiment with new technologies and tools, we wanted students to see the advantages and the limitations of gen AI, but also understand the prompt design process, reviewing and refining responses within an engineering design cycle. Society adapted to the introduction of calculators, so how do we learn to work with this newer tool?

Implementation: Key for students was to develop their awareness of usage cases for gen AI. 'Good' and 'bad' examples were presented for class discussion on the merits and limitations of AI. The students involved were not engineers, but a mixed undergraduate class at Dublin City University. Sessions took place during 2024 using ChatGPT-4.

Results: Students found it easier to give honest feedback and discuss the strengths and weaknesses because it was created using gen AI, rather than using anonymised student work. Non-experts can initially find it hard to discern quality of AI produced text. More sophisticated analysis skills can be developed by reading in detail and discussing, then the limitations of gen AI become more apparent.

Challenges and Lessons Learned: Students more easily engaged with the "bad" example where gen AI was used to outsource all work, rather than engage higher level editing and curation skills. The natural language interface resulted in students struggling to identify initial question framing as important, preferring to refine queries after an initial run instead.

Conclusion: Clearer guidance on the benefits and limitations of gen AI is needed to support student understanding as information students receive on AI comes from sources who are either very positive or very negative and lacking nuance. As with any new technology, education is vital to students making best use of it.