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Discussion: Are engineers being over-value-engineered?

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The contributors write in support of Yvonne Ainsworth's briefing, 'Are engineers being over-value-engineered?' (Ainsworth, 2019). The paper and the contributors' comments focus on geotechnical engineering, which is also the contributors' specialist field, but similar concerns clearly pertain to infrastructure and civil engineering more generally. The issues are not new, but the contributors would agree that the situation is continuing to worsen. The contributors would draw attention to some background and references.

The paper identifies increasing pressures to drive down design costs and take on increasing risk, leading to ensuing problems and even disasters. The remarks precede the impact of coronavirus disease, which can be expected to worsen this situation.

The contributors' recent paper in this journal entitled 'Grounds for concern' (Tonks *et al.*, 2017) reviewed over 100 geotechnical forensic cases from the contributors' files and commented on 'the seemingly increasing number of construction failures related to the ground, contrasted with the vast increases in knowledge.... The authors are led to the conclusion that the overwhelming majority of issues arise from human factors rather than the ground itself' (Tonks *et al.*, 2017: p. 163). The contributors followed this up in the Tonks *et al.* (2019) paper, which concluded that although the vast majority of construction works do identify and address the risks in the ground with ever-increasing success in economy and safety, a significant number of problem cases that arise primarily because appropriate and available geotechnical expertise is not suitably engaged.

In the contributors' experience, the forensics caseload continues to grow and reaffirm these findings. As a senior lawyer remarked, 'there is all the time and money in the world to investigate when a failure does occur'. Unfortunately, there do not appear to be effective 'feedback loops' encouraging more to be spent before failures occur!

The role of design continues to be devalued by those who see it as a commodity. There clearly are aspects of engineering that can be refined and value-engineered to a very high degree. Ground and infrastructure works are simply not like that. Money spent on design should lead to far more money saved on construction. Money not spent on design is directly responsible for disproportionate construction costs and delays and a principal cause of failures.

Recent Institution of Civil Engineers presentations on a major incident repeated laments by very experienced engineers that fee levels are unsustainably low. It is the contributors' experience from numerous cases that these often involve designers taking on undue risks and responsibilities for surprisingly low levels of reward, arguably due to 'commercial considerations'. Some recent cases come to mind where fairly straightforward schemes more than doubled in cost and time. A designer explained with some irony, 'we had a very limited budget and the project was driven by cost!' Comparable issues continue to underlie delays, cost overruns and even serious failures on major projects, as well as on numerous lesser cases.

There have been many similar warnings over the years, one of the most erudite of which is Sir Alan Muir Wood's book *Tunnelling: Managing by Design* (Muir Wood, 1990), which includes much on Heathrow and other tunnelling incidents of the 1990s. A central theme is how such problems could and would be avoided when the project was under the control of experienced designers. Time and again, the geotechnical risks are 'undervalued' by a prevailing project-management syndrome, which has a poor track record in addressing ground risk.

The question remains what can be done about it? The Register of Geotechnical Engineering Professionals (ICE *et al.*, 2013) was set up some years ago and is increasingly used by some organisations experienced in infrastructure and ground risks. The salary figures quoted by Ms Ainsworth for such professionals do indeed show grounds for concern. They reflect much wider issues of attracting and retaining high-calibre people to the profession.

The forensic cases that the contributors have studied commonly involve failure to engage adequate expertise – some have been pleaded as such. These continue to provide good business for the legal profession and their advisers. The contributors' papers add to many past warnings and seek to head off some avoidable disasters and the considerable distress to parties caught up in these. Ms Ainsworth's comments are well made. The contributors can only hope that they will be duly heeded. Geotechnics and civil engineering design more generally remain fascinating and challenging fields that need to involve and support the highest calibre of professionals. Cost-cutting on design and designers is the antithesis of value engineering.

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