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Engineering History and Heritage

Editorial

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Is engineering relevant? This is a question I have been wondering how to answer effectively in the past few years. In a world of artificial intelligence software and commodification of professional services, it may be argued that engineering is gradually becoming obsolete. Computers can do calculations faster, AI can build from algorithms while learning from examples, and some of our largest global engineering firms have become 'investments' which are focused on processes that have clear controlled steps to maximise profit. In the current construction world, it could be tempting to focus on engineering as a bankable mean to make money, which would be a slight but important departure from our traditional primary purpose.

I think the papers in this edition of the journal are interesting examples of why, despite all these pressures, we remain relevant. Why despite the changes in the world or changes in our industry, there will always be engineers taking on complex problems, who will apply science in a practical way, for the betterment of society.

The first paper (Masterton, 2023) looks at the importance of past knowledge to improve future design. It underlines how it is important to understand the context of which a problem exists as a necessary step to the depth of insight required for finding new or innovative solutions. Yes, it is possible to practice engineering without a good understanding of past practice, design, or reasoning; however, anyone that does this will never have the ability to grow beyond routine and clearly defined tasks. Without understanding the past, a person cannot grow specific tasks that are better executed by AI systems. The paper reminds us of how cutting-edge engineering is not done in spite of our past, but from building upon our past. We should remember that while structures have changed over the last few thousand years, there have always been intelligent people solving problems – present day engineers have no monopoly on intelligence.

The second paper (Masui and Chang, 2023) takes us back 400 years to look at Japanese fortifications. Looking into the paradox in the world of engineering, it can be harder to understand a structure standing in front of you than to understand something that has not yet been created. Historic fortifications in a country with high seismic risk; how safe are they? To evaluate likely performance under extreme load scenarios is an intriguing and unique puzzle. There needs to be an alignment of quantitative, qualitative, and historic data sets to understand likely performance and develop guidelines in evaluation. This complex problem requires a knowledge of the past structure, and our ability as a profession to tackle such problems is important to help society through current challenges.

How society will move through the challenge posed by climate change has become a dominating international issue. It is clear that decision makers should consider carbon impacts in their plans. It is less clear how this relates to the evaluation of historic Japanese fortifications, yet no less pertinent. As structural engineers strive to make the structures around us safe, we are called to not be excessive in how we do so. In the *Calculating Carbon* publication by the Institute for Structural Engineers, they estimate that the typical Structural Engineer is responsible for a million kilograms of carbon in their structural design per year. Where the carbon footprint of a person is in the range of 10 to 16 thousand, this number is huge. Our first goal is to build less, our second goal is to use what we have, and in both instances, the better we can predict the performance of our existing structures, the more we can reduce our carbon footprint.

The final paper (Krishnachandran *et al.,* 2023) brings us to a structure built in the 1960s. The concrete dominate structure may feel similar to our current design, but don't be misled. This paper provides the background on how it is anything but typical. The importance of not just the materials, but of the technology and ingenuity used at the time presents a wealth of lessons for how we can improve current design. Through more detailed evaluation of the SVP Stadium in Ahmedabad, the team was able to focus any potential seismic intervention, allowing continued use of the iconic structure while minimising financial and carbon impacts on the stakeholders. This paper links back to the first, in showing how understanding of the past helps drive us forward and create better solutions for the future.

History has shown us that the greatest threat to society will continue to change. Engineers have a unique role in how we support society through working out details behind the scenes. As Rudyard Kipling alludes to, our role is often a rather thankless task. Yet our role is relevant. We are not relevant because of codes or regulations. We are not relevant because of titles or rings. Our profession is relevant in how we identify, understand, and take on problems working through details and finding ways to apply science in a practical fashion to help society. Our profession does its best work in situations that are not typical, and complex problems call for more than a prescriptive answer. I enjoyed the papers here for how they capture our capabilities and give us ideas for how we can do more.

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