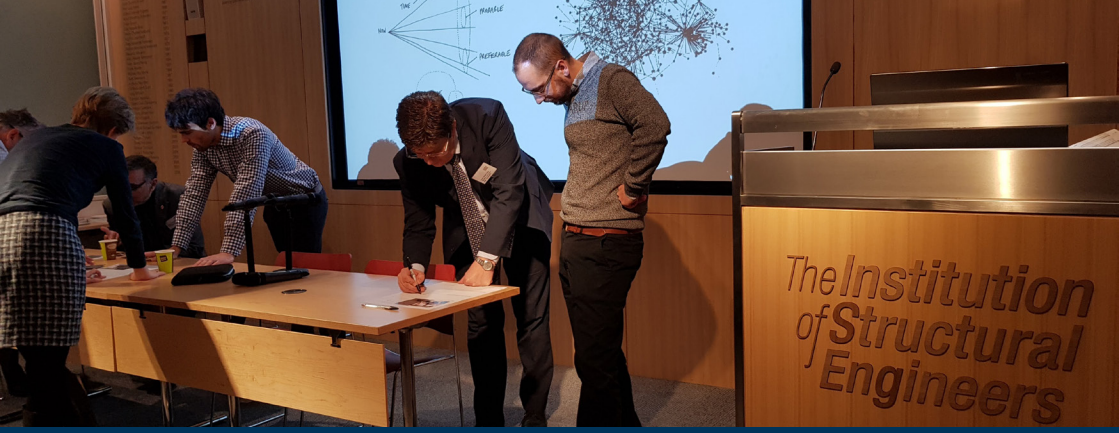

Workshop summary

The future of our profession

Institution of Structural Engineers
Council Meeting | February 2018

This report summarises the Council Meeting workshop held on 23rd February 2018 at the Institution of Structural Engineers in London. The workshop was organised and delivered by Arup's Foresight team in collaboration with the Institution of Structural Engineers. This report gives an overview of the key topics of discussions, findings and priorities. It furthermore links to materials and resources for future reference and reuse.

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Overview of the day

Outline and objectives

This February's Council workshop focussed on the future of the structural engineering profession. The day was split into two parts; the morning concentrated on what the profession will look like in 10-15 years' time; the afternoon explored the role of the Institution in supporting the profession going forward.

Josef Hargrave, Global Foresight Manager at Arup, started off the day with a keynote presentation outlining changes we are seeing in our industry and what this may mean to our shared future.

Watch Josef's presentation.

In the first workshop exercise of the day participants looked at some of the major disruptive trends, prioritised key topics and explored their implications for the built environment and the profession.

The second workshop saw a discussion of three key themes and their impact for the Institution. The themes were: New construction methods and systems by Alan Clucas (Explore Manufacturing); City resilience by Caroline Field (BuroHappold Engineering); and Designing with data by Mike Hayley (Autodesk (recorded presentation)). The presentations were followed by a discussion around the impact of the themes and how to ensure continued and relevant support to the institution's members and the wider public.

The future of our profession

Summary of key findings

Workshop 1:

‘What will the profession look like in 10-15 years’ time?

In this workshop participants reviewed and prioritised some of the major trends disrupting our industry and explored their implications. The below summarises the trends that were seen to have the greatest impact on structural engineering and the built environment industry.

System Integration

Engineers will need to take a broader more strategic role and drive integration and collaboration with other professions, not just architects. The profession should focus more on the overall building design, beyond traditional structural engineering. The education system will need to reflect this broadening of expertise, move beyond teaching the skills that will in many cases be replaced by automation, and integrate both digital and artistic skills into the curriculum to enhance collaboration and creativity.

Data

Data will give greater insight into building design and construction. This will require the industry to become more data and tech driven, to consider data collection at the outset of a project. Greater collaboration across built environment expertise as well as technical expertise will be essential to achieve valuable data capture and analytics.

Nanotechnology & new materials

Developments in nanotechnology and new materials offer seemingly endless opportunities for the industry. In order to make the most of this potential and transform the industry we need to invest more in research & development, apply new solutions and innovation in real projects, and collaborate more closely with scientists and architects.

Artificial Intelligence

AI will have a huge impact on design processes and is likely to highly disrupt current ways of working. The possibilities AI will bring are both an opportunity and a threat, and outcomes will depend on how we respond and prepare for it now. It is fundamental that the education system grasps the opportunity and prepares the future workforce for the changing demand, processes and challenges that developments in AI hold.

Internet of Things

To make the most of IoT developments we need to learn from other professions to apply this learning to the structural engineering context. Connected networks provide masses of data that require smart analytics and decision making to generate valuable insight. Sensors need to be strategically integrated to add to a useful data pool. Clients will increasingly expect the integration of IoT networks; in order to get ahead of existing tech giants we will need to generate greater synergies between digital and structural engineering.

Workshop 2:

‘What might be the role of the institution in supporting the profession?’

In this workshop participants were briefed on one of three topics with large potential for disruption for the industry: Designing with data, new construction methods, and City resilience. The following discussion focussed on the impact on the profession and implications for the Institution in continuing to provide relevant support to its members.

Designing with data

Greater availability of data, smart analytics and human - intelligent machine interactions will change today’s work processes: people will set criteria (e.g. material, form), which AI tools will turn into a near endless amount of design variations; engineers will then review and select the final solution based on best fit and informed by data insight.

This will transform the role of the engineer today, moving away from analysis and calculations to a broader skill set, including software engineering and application, and coding. This will be reflected in the engineering curriculum. Furthermore, this change could disrupt traditional company structures and models, and poses questions of data ownership, protection and security.

Embracing the power of data and artificial intelligence could lead to greater insight into structural performance and better informed design solutions, and a greater consideration of human factors will yield insight into beneficial

and harmful designs. The professions will also integrate and operate more closely across and beyond built environment disciplines, potentially merging currently separate disciplines. There's also an opportunity to more closely couple industry practice with academic research, offering collaborative learning and accelerated innovation.

New construction methods

Advances in construction, including robotic and modular methods, will transform the industry and the role of the engineer. We will see a move away from designing structural elements to integrating a greater understanding of construction, componentisation and software engineering. New roles in modelling could also emerge. A greater collaboration between constructors and designers will be required, and should be led by engineers.

Buildings will increasingly be modularised and manufactured off site and clients will need to be educated to appreciate this change. With greater human-machine collaboration we need to pay close attention to the design of interfaces and interaction points.

University education will have to adapt to changing requirements, including the curriculum and a selection from a broader pool of students.

City resilience

The risk of climate change, including an increase in flooding and extreme weather events will bring resilience to the top of the agenda. Buildings and infrastructure will need to be designed with resilience in mind in order to withstand extremer weather and major events in the future. This requires a mindset shift from designing for today to building in resilience to extreme scenarios, similar to an earthquake engineer's approach.

Resilience is a very broad and complex matter that concerns whole systems and therefore needs to be considered across disciplines. It is an emerging field with broad opportunities for the profession; a good understanding of the topic will help define our position and role within it early on.

It will be key to introduce (structural) resilience into the dialogue with clients and collaborators, to integrate it into briefs and build into future designs. The education system needs to consider what new competencies and knowledge will be required to cater for this new approach. The institution could play a key role in educating its members about the topic (incl. through IPD, CPD and specialist diplomas) to accelerate industry transformation and enable an educated dialogue with clients about the importance and value of resilience engineering.

Priority areas

Following plenary discussion across the three main themes, key priority areas for the Institution to consider were summarised as:

1. Need to **rethink the education of engineers** to prepare them for a changing future role. What should be the skills and competencies of a future graduate?

2. Include **millenials and digital natives** in the committee structure to reflect changing demographies in the member base.

3. Aim for **greater engagement with the construction industry and contractors**, as the design/ construction interface is broadening.

4. Enable a **broader outlook** and engagement across the built environment industry and beyond, reflecting a broadening of skills and the disappearance of silos.

5. Build **greater links between research and practice**, and make the environment a living laboratory, e.g. through greater use of sensors to test research application.

6. **Educate members on key areas of disruption** (incl. resilience) by making them a core objective in IPD, with CPD provision and as specialist diplomas.

7. Adress membership levels to see they reflect a more digital future. **Enable progression of technicians**. Consider how to support the development of apprenticeship degree programmes.